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CONSTRUCTORS OF BY-PRODUCT COKE AND GAS OVENS,

5 S. Wabash Avenue, - - - - Chicago, Illinois.

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[Communicated.]

General Description of the First Gas Oven Plant Erected in this Country.

Much interest has been evidenced the last few years in devising new methods for carbonizing coal in gas plants, with a view of increasing yields of gas and ammonia, increasing the quality of coke and tar, and particularly in reducing the amount of labor employed at the works.

Some of our largest cities have solved the problem by buying rich gas at the ovens of by-product coke plants located in their near vicinities, and purifying and distributing this in connection with a relatively small amount of coal or water gas made in their own plants. Such service is not always reliable or dependable, as the coke oven plants are operated to meet the demands of the coke trade, and if this is at a low ebb the quantity of coal carbonized is reduced; likewise the volume of gas available to the local gas company.

The result is that some of the companies so served have adopted a policy of installing sufficient water gas capacity each year to take care of the annual gain in gas sales. This, of course, insures to the public a reliable gas service, but increases the plant investment, besides necessitating a large force of competent operators under salary to be prepared for emergencies.

Other companies have tried improvements in gas bench construction, using various forms of horizontals with stop ends, horizontal throughs, inclines and verticals, all of which are giving more or less improved results, but without reaching the high point of efficiency demanded. The like problems have confronted European engineers for many years, and, because of their local conditions, presented an even more serious cause for a departure from fixed lines than with us.

This prompted Messrs. August Klonne, of Dortmund, to begin an investigation of possible improvements, which, after extensive and expensive research and experiments, resulted in "chamber retorts" from which were afterwards developed chamber ovens.

These are constructed along the general lines of by-product coke ovens, with modified methods of heating the chambers, using twin furnaces with recuperators for this purpose, instead of lean gas, as with coke ovens, and in applying the heats to the chambers in such a manner as to insure proper carbonization of the coal, recovering all the gas of a quality suitable for commercial purposes, and in quantity in excess of that resulting from any other method now employed.

The advantages of the process so favorably impressed Mr. James E. Stacey, the head of the well-known Stacey Manufacturing Company, of Cincinnati, O., that he determined, if possible, to secure the American rights for installing chamber oven plants. Successful negotiations on his part resulted in securing the exclusive patent rights of the Klonne system for the United States, Canada and Mexico. He then organized the National Chamber Oven Company, with offices in Cincinnati, O., for exploiting the process.

About the same time the owners of the Central Indiana Gas Company, who were supplying natural gas to a number of cities in Central Indiana, were confronted with the necessity of building an artificial gas plant to furnish gas to displace the rapidly failing natural gas supply, and when the chamber oven system was brought to the proprietors' attention, they at once realized how splendidly this process would meet their requirements.

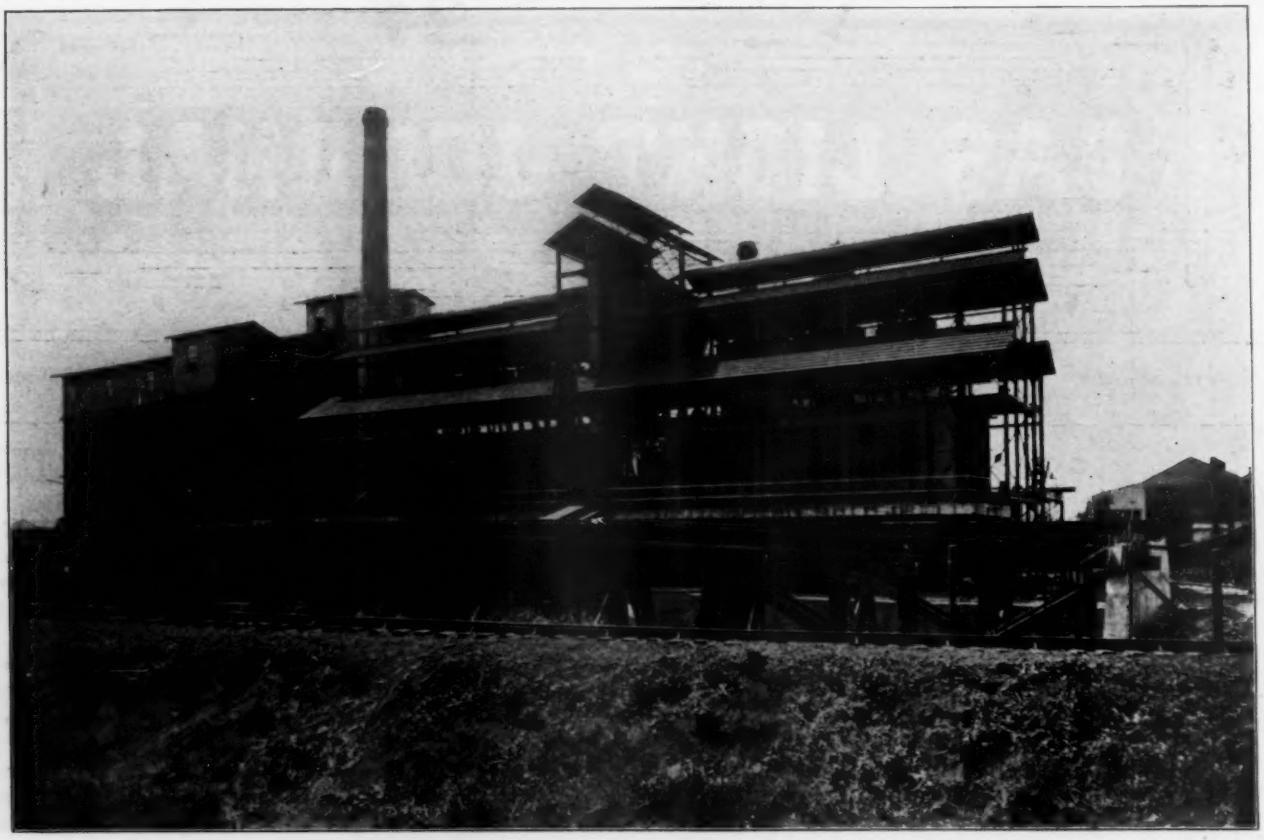
They also appreciated the importance of making no mistake in reaching a decision, and, to insure against this possibility, commissioned Mr. Joseph C. Markley, their Managing Engineer, to investigate all new processes, both in this country and abroad.

Mr. Markley's report, following this investigation, resulted in their placing an order with the National Chamber Oven Company to construct, at Muncie, Ind., a chamber oven plant of an initial capacity of 1 million cubic feet a day, with provisions for increasing the capacity as the output required.

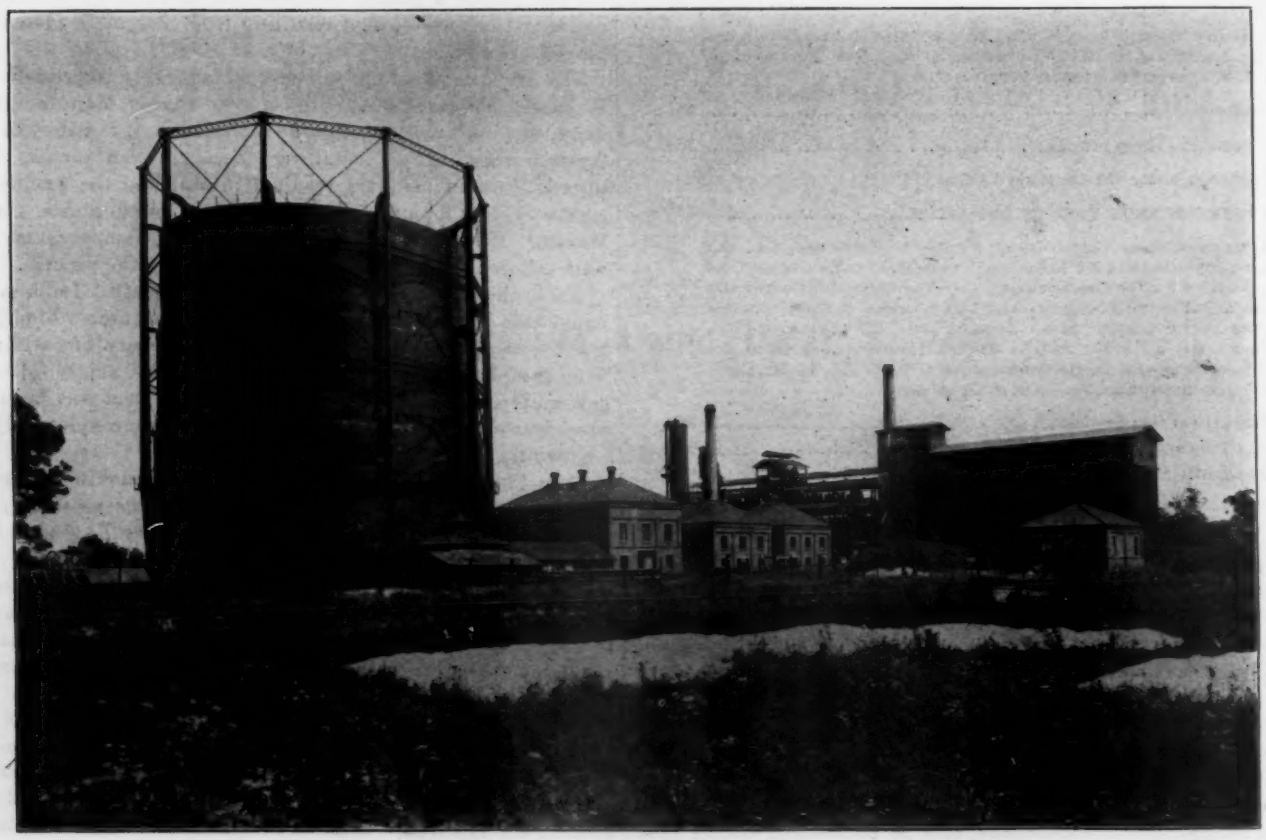
After giving careful consideration of the requirements of the situation, with due regard to flxibility in send-out, and economical operation, it was decided to install two batteries of ovens, each battery containing 2 ovens of 4 chambers each, and 1 oven of 3 chambers, making 6 ovens with a total of 22 chambers. Each chamber was designed to take a charge of 5 (net) tons of coal, and to run on 24 hour charges. This makes the maximum capacity of the plant 110 tons of coal per 24 hours, or 10 per cent. in excess of the carbonizing capacity originally contemplated. A general view of the ovens from the pusher side is illustrated in view No. 1.

To explain the terms "Ovens" and "Chambers," it may be stated that the denominator "Ovens" is used to express in this process what "Bench" would mean in ordinary coal gas practice, and "Chamber" is relatively the same to oven as "Retort" would be to "Bench."

Each oven is heated with twin generators, operating with a system of horizontal recuperators, the generator fuel being coke. The waste



View No. 1.



View No. 2.

gases from all the recuperators are led into a horizontal flue under the foundations, which flue is connected to the oven chimney.

The damper system employed permits very close regulation of the primary and secondary air, and a master damper in the main flue insures general regulation of the drafts, which are further carefully regulated by individual dampers at the connections of the recuperators to the main flue.

Should the demands for gas be in excess of the rated capacity of the ovens, which is based on 24-hour carbonization, the heats may be increased by proper operation of the dampers, so that the charge may be "burned" off in 18 hours; and, if the demand is reduced, the heats may also be reduced and the carbonizing period extended to as much as 36 hours with a resultant increase in the quality of coke.

The coal storage in this plant extends parallel with the operating floor, this space being excavated and the entire storage being paved and the sides built up with the retaining walls. Two railroad tracks extend the entire length of the coal storage, same being built on tresles. (See View No. 1.)

The coal is received in dump cars, that intended for storage being unloaded in the main storage yard.

The coal for current use is dropped from the cars into hoppers suspended under the railroad tracks, and is fed from these receiving hoppers to a coal conveyor under the floor and extending at right angles with the railroad tracks. This coal conveyor delivers the coal to the crusher, where it is cracked into sizes not to exceed 1¼-inch cube, and it is then delivered from the crusher to an elevator conveyor, which delivers it into the elevated storage bin.

The coal is discharged from the overhead bins into motor-driven larries, which run over the charging nozzles of the ovens. The coal is accurately weighed on automatic registering scales, located immediately under the coal valves in the overhead storage bin.

The general method of operation is as follows: In charging a chamber the end doors are first closed, the coal being then discharged from the coal larries into the chambers through feeding nozzles opening into the top of the chambers. The coal is leveled by means of a plow operated through an auxiliary opening at the "machine" end of the chamber. This plow is part of the coke pusher hereinafter described.

In discharging, the standpipe of the chamber is first opened and the front and rear doors removed. The door on the discharge (or coke) side is removed by a hand-power door-lifter, running on overhead tracks. The door is first released, then brought out from the face of the chambers a sufficient distance to clear the buck bars, then moved sidewise to clear the opening and permit the "pushing" of the coke, The door-lifter on the pusher side is auxiliary to the pusher, and is operated by the motorman in the pusher cab. After the doors are removed, the pusher, which is motor-driven and the ram of which is of the "link" type, to minimize the clearance space required, is run into and through the chamber, pushing the coke out at the discharge end.

The hot coke falls on an inclined quenching platform, provided with coke valves at the lower end of the slope, through which the coke is discharged after being quenched by means of fire hose.

The quench coke is handled from the inclined coke floor through coke valves into cars, with side dumps. These cars are pushed by hand onto the coke elevator, from the shaft of which it may be placed into the furnace fuel bin, dumped directly into cars for shipping, into the boiler room for fuel purposes, or run through the crusher and screens, and deposited into the storage bins arranged for the various sized coke.

The doors at each end of the chambers are self-sealing, and are the first doors of this type to be successfully used in oven practice. By noting the accompanying illustration the degree of tightness of these doors may be noted, as ½ of the chambers shown are in actual commission, the others not having been brought to heat at the time the photos were taken. In closing, the doors are handled by the mechanical door-lifters above referred to, the only manual labor in sealing the door to the frame, being the turning of the hand wheel shown on the door. A general view of the entire plant is given in view No. 2. This shows the discharge side of the ovens, with the coke storage bins in the background, the boiler house, exhauster and compressor house, and the apparatus building lying between the ovens and the holder; the governor house, located at the side of the holder, with the works office and laboratory at the right.

The tower rising over the buildings from the rear of the boiler house is the naphthaline cooler condenser, through which the gas passes when leading from the hydraulic main to the exhausters. This is fitted with by-passes so that one-third, two-thirds or the entire shell may be utilized, thus insuring wide flexibility for differential in make or weather conditions.

The exhausters, which are in duplicate, are mounted on an elevated floor giving free access to all connections, drains, etc., beneath. Located in the exhauster building are the compressors, also in duplicate, for pumping the gas to the surrounding cities and towns supplied from this plant.

The boiler capacity is ample to take care of the operation of the entire plant, including the heating of buildings and holder tank and cups, leaving one unit in reserve for emergencies.

The condensers and washer coolers located in the apparatus building are especially designed for this plant, the washer coolers being of the bell type with a high degree of efficiency.

This apparatus is all built on a superstructure leaving free headroom beneath all machinery and connections, and so designed that, by installing an additional washer and condenser, the capacity will be increased to more than 2 millions cubic feet per day.

The purifiers are of the duplex-type, built of steel, are 25 feet in diameter, and 12 feet in depth, the gas entering at the center of the box and passing up-and-down through the oxide to a common outlet duct.

The meter is 9 feet in diameter, fitted with a Hinman drum, and is installed in the main apparatus room for the present, it being planned to build a meter house when the ultimate capacity of the plant is reached.

The gasholder at this station is a 3-lift, steel tank construction of ½ million capacity, and similar holders are also located at Anderson and Marion, with a 400,000 cubic foot capacity steel tank holder at Elwood.

Too much emphasis cannot be placed on the small amount of labor necessary to operate the manufacturing plant.

At this time a considerable amount of auxiliary labor is employed in completing details of constructions, and cleaning up the yard, but a conservative estimate indicates that, including the works' superintendent and chemist, the total men employed about the plant for each 24 hours, for all purposes, including coal and coke handling, will not exceed 12. Operating results thus far obtained indicate that this plant will, when running under normal conditions, produce 100,000 cubic feet per day per man of the total number employed at the works.

The management of this plant is exceedingly liberal in giving interested visitors access to the works, and many have already taken advantage of the opportunity to inspect the first gas oven plant erected in this country.

The Venturi Gas Meter.

The proprietors of the Builders' Iron Foundry, Providence, R. I., inform us that they have now perfected the well known Venturi meter, which they have been manufacturing for about 20 years, for the measurement of air and gas. The principle upon which this meter is based was first announced (1797) by the Italian philosopher and diplomat, J. B. Venturi, who discovered that liquids flowing through a diverging pipe show an increase in velocity and a decrease in pressure at the small end. One hundred years later Clemens Herschel, Hydraulic Engineer, applied this principle to the accurate measurement of water in large pipes, for which purpose this type of meter has been extensively installed throughout the world, in all

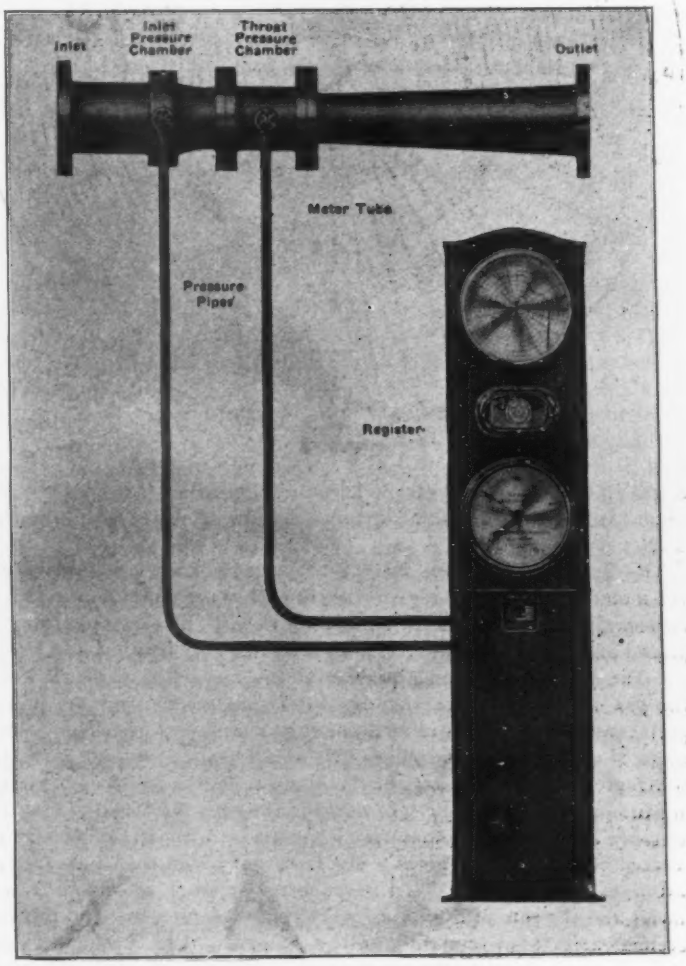


Fig. 1.

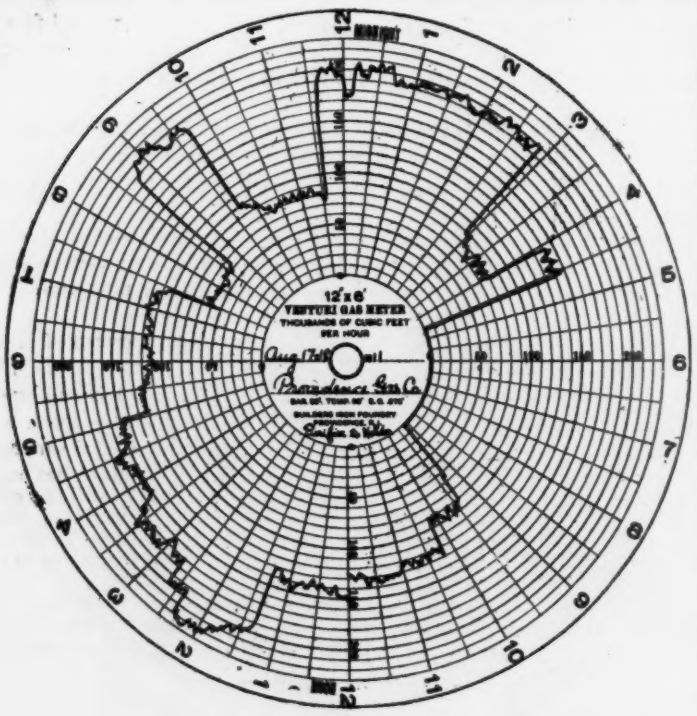


Fig. 2.

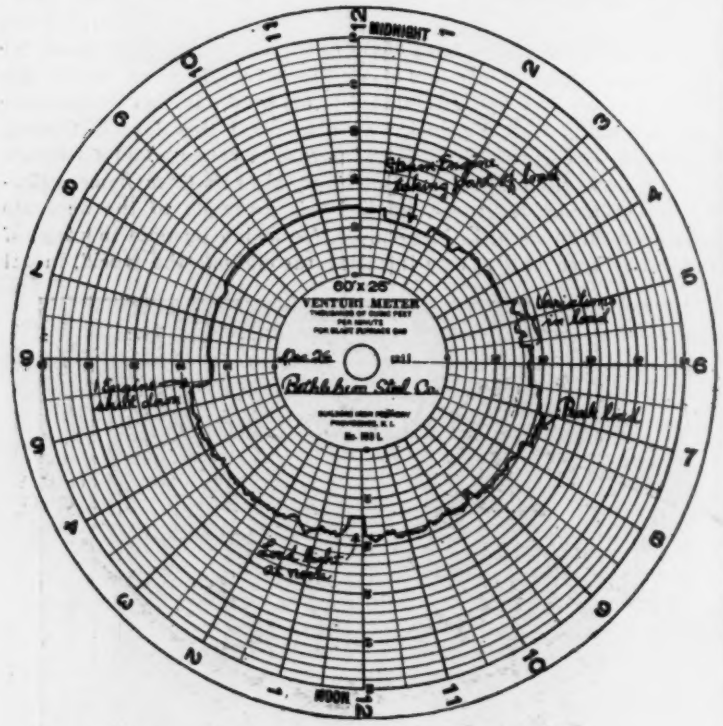


Fig. 3.

sizes, up to 17½ feet diameter. Three of the latter size were recently placed in the great Catskill aqueduct system of water supply to New York City.

The Venturi meter consists of 2 main units, known respectively as the meter tube and the registering device, which are connected by two small pressure pipes, as shown in Fig. 1. The register may be placed above or below the meter tube and at any distance away from it. The meter tube forms a portion of the main line through which the gas flows, and it carries absolutely no mechanism or interior parts, and it is set in the same manner as a section pipe. The general shape is of two truncated cones, the small ends of which form the contracted portion or throat of the meter tube, the outlet ends matching the pipe line diameter. In accordance with the Venturi law, the pressure at the throat is materially lessened, owing to the greatly increased velocity at that point. Mr. Herschel found that a definite relation existed between the difference in pressure at the inlet and throat and the rate of discharge through the meter tube, and this difference varies approximately as the square of the throat velocity. After the gas passes the throat the velocity begins to diminish, with a consequent regain in pressure, so that when the outlet is reached nearly all of the pressure temporarily lost at the throat has been restored. Practically, therefore, as much gas will be discharged through a Venturi meter tube as through a straight pipe of equal length forming a portion of the main line.

The difference in pressures conveyed by the two small pipes operates a substantial float mechanism in the registering device, which in turn controls the readings. The register has 3 dials, as shown by Fig. 1, the lower of which is 10 inches diameter and indicates the rate of flow through the meter tube at the moment of observation. The upper dial records this rate on a circular chart. The middle dial shows the total number of cubic feet which have passed through the meter tube. As the operation of all dials is continuous, the register, therefore, furnishes three distinct kinds of information each of which is valuable in checking the efficiency of operation of gas plants. The charts shown in Figs. 2 and 3 are reproductions (reduced in size) of charts obtained from meters in actual service. Fig. 2 illustrates the variation in consumption on a 12-inch Venturi meter in a gas company's plant between purifier and holder, and Fig. 3 portrays the variation in gas consumption of a large steel company's gas engine power plant, showing the instrument to be very sensitive to small changes in the rate of gas used by the engines. It should be noted that this meter is 60 inches diameter (for a 60-inch pipe line), and has a maximum measuring capacity of 50,000 cubic feet per minute.

Effect of Various Diluents on the Candle Power of Oil Gas.

[A paper read by Dr. Arthur H. Elliott, (New York) before the American Gas Institute.]

The following experiments were made in order to ascertain what effect the so-called diluents in illuminating gas had on the illuminating power of such gas. It has been known for many years that, if you mix oil gas with true water gas (carbon monoxide and hydrogen) a considerable volume of oil gas may be added before any illuminating effect appears in the flame. The determination of the actual extent of this effect was the cause of the investigations given in this paper. Unfortunately, when the experiments were made, no true oil gas was obtainable; but a mixture of water gas and oil gas rich in the latter was used, and the data herewith presented were obtained. It is hoped they will be a useful contribution to applied chemistry.

The first step in the investigation was the preparation of a quantity of carbon monoxide. This gas was made by heating a mixture of oxalic acid with concentrated sulphuric acid, and washing the products with water and sodium hydroxide solution. This gas was free from carbon dioxide, and on analysis gave the following results:

Carbon monoxide	94.5
Oxygen	1.1
Nitrogen	4.4

The gas thus prepared was mixed in a regular 5 cubic foot test holder, having an annular water ring tank with a generator oil gas having the following composition:

Oil Gas A.	Per Cent.
Illuminants	30.9
Oxygen	0.7
Carbon monoxide	13.3
Hydrogen	12.8
Marsh gas	39.6
Nitrogen	2.7

Making a regular photometric test, using a Bray, 1-foot acetylene burner (the gas burning at the rate of 1 cubic foot per hour), the candle power of this gas was 41.3 for a 5 cubic feet rate per hour. Assuming that water gas contains 44 per cent. of carbon monoxide, by calculation, the above oil gas mixture contains 70 per cent. of oil gas (illuminants, marsh gas, etc.). By calculation, if this oil gas mixture was free from water gas, its illuminating power would be 59 candles for a 5 cubic feet rate per hour. This is calculating for dilution only.

Using the two gases above tested, two mixtures were made from them containing approximately 10 and 30 per cent. of the oil gas. By actual measurement, the following mixtures were obtained:

	Volumes	
	No. 1.	No. 2.
Carbon monoxide	91.0	67
Oil gas A	9.0	33

These mixtures contained the following gases per cent. by volume:

	No. 1.	No. 2.
Illuminants	2.8	10.2
Oxygen	1.2	0.8
Carbon monoxide	86.2	66.8
Hydrogen	1.2	4.2
Marsh Gas	3.7	13.0
Nitrogen	4.9	5.0

Making the regular photometric observations, the gases burning at the rate of 5 cubic feet per hour in a flat flame Bray burner that appeared best adapted to the flame, the above mixtures gave the following candle powers:

No. 1 = 1.0 No. 2 = 14.7

The next observations were made upon a mixture of hydrogen and oil gas (Sample B). The hydrogen gas was made with zinc and sulphuric acid, and well washed with water. This gas contained 97.6 per cent. of hydrogen, 0.5 per cent. of oxygen, and 1.9 per cent. of nitrogen (from air). As this test required a new sample of oil gas, an analysis of the oil gas used was made, with the following results.

Oil Gas B.	Per cent.
Carbon dioxide	0.5
Illuminants	31.5
Oxygen	0.7
Carbon monoxide	11.7
Hydrogen	13.8
Marsh gas	38.8
Nitrogen	3.0

A regular photometric test made with a Bray, 1-foot acetylene burner (as with Sample A), gave for the candle power of this gas, if burning it at a rate of 5 cubic feet per hour, 52.3

As it was expected that hydrogen would behave like carbon monoxide in giving a low candle power, the 10 per cent. mixture was omitted, and a mixture of oil gas B and hydrogen was made as follows:

	Volumes.
Hydrogen	67
Oil gas B	33

This gas mixture had the following percentage composition:

	Per Cent.
Illuminants	10.4
Oxygen	0.6
Carbon monoxide	4.0
Hydrogen	70.0
Marsh gas	13.0
Nitrogen	2.0

The candle power of this mixture, burned in a Bray flat flame burner, at 5 cubic feet per hour, was 20.5.

Calculating from the carbon monoxide (44 per cent.) in water gas, the oil gas B, contains 73.4 per cent. of true oil gas. Also, calculating from the candle power (52.3), if water gas was absent the candle power of the oil gas would be 71, burning at a 5 cubic foot rate per hour.

Another mixture was made, using marsh gas and oil gas C, which latter had the following composition:

Oil Gas C.	Per Cent.
Carbon dioxide	0.5
Illuminants	30.6
Oxygen	0.4
Carbon monoxide	5.9
Hydrogen	17.6
Marsh gas	42.3
Nitrogen	2.7

The candle power of this oil gas, burned in a 1-foot Bray acetylene burner, and then calculated for 5 cubic feet per hour, was 50. The marsh gas used was made from aluminum carbide, and had the following composition:

	Per Cent.
Carbon dioxide	....
Illuminants	....
Oxygen	0.2
Carbon monoxide	....
Hydrogen	8.3
Marsh gas	90.6
Nitrogen	0.9

The candle power of the marsh gas was 4.5, burning at a 5 cubic foot rate per hour. By calculation, oil gas C contains 86.6 per cent. of oil gas (water gas = 44 per cent. carbon monoxide). Calculating from the candle power (50) obtained with this oil gas, and that it contains 86.6 per cent. of oil gas, this oil gas free from water gas should have 57.7-candle power.

The marsh gas and oil gas C were combined in the following proportions:

	Volumes.
Marsh gas	91
Oil gas C	9

The composition of this mixture is as follows:

	Per Cent.
Carbon dioxide	0.0
Illuminants	2.8
Oxygen	0.0
Carbon monoxide	0.5
Hydrogen	9.2
Marsh gas	86.3
Nitrogen	1.2

Burned at the rate of 5 cubic feet per hour, this mixture has a candle power of 7.7 in a Bray flat flame burner.

In testing the several gas mixtures made and used above, the following data are obtained. In the oil gas mixtures used to start with, called oil gas A, B and C, we note the following values in regard to candle power:

	Candle Power.
In oil gas A, 1 per cent. of illuminants	= 1.337
" B, " "	= 1.660
" C, " "	= 1.634

The candle value of 1 per cent. of illuminants as given above may be stated thus: If in gas B the illuminating value is taken as 100, then gas A is 80 and gas C is 98, which gives the relative value of the illuminants in the various oil gas mixtures used in the experiments, and shows that the illuminants are not of the same candle value in each gas. But when we begin to add more carbon monoxide to the oil gas mixture A, we obtain a loss of candle power which is more than the effect of dilution would lead us to expect. Taking mixture No. 1, we see that there is 2.8 per cent. of illuminants in it, obtained from oil gas A, where each per cent. of illuminants is equal to 1.337-candle power (at the 5 cubic foot rate). Therefore, if we multiply the candle power of each per cent. of illuminants by 2.8, we obtain a value of 3.74-candle power; whereas by actual test we only obtain 1-candle power—a loss of about 75 per cent. of the light. Applying the same calculation to mixture No. 2, we obtain 14.04 as the candle power of the gas mixture; while an actual test gives 14.7 for this mixture—a fairly good concordance, and practically little loss of light.

Looking, now, at the experiment with a mixture of oil gas and hydrogen, we obtain the following figures: 1 per cent. of illuminants in the oil gas used (B) is equal to 1.660-candle power (at the 5 foot rate). In the mixture with hydrogen, we have 10.4 per cent. of illuminants, which, multiplied by the value of 1 per cent. of illuminants in the oil gas used (1.660), gives 17.3 as the candle power of that mixture after dilution with hydrogen. But when we apply the photometer to the mixture, we get 20.5-candle power, when burning at a 5 cubic foot rate per hour. This is an increase of candle power of over 18 per cent., which is clearly due to the influence of hydrogen in the mixture. Or the candle value of 1 per cent. of illuminants in the hydrogen mixtures becomes 1.952, instead of 1.660, which it has in the oil gas C used. Or, if we compare with the corresponding mixture made with carbon monoxide, we have here an increase of 39 per cent. in the candle power.

The mixture of marsh gas with oil gas gives us some more interesting data. In the oil gas C used in this latter test, we have 1.634 as the candle value of 1 per cent. of illuminants; and we make a mixture of this gas with marsh gas—the final mixture having 2.8 per cent. of illuminants. By calculation for dilution from the oil gas value (1.634), we get (1.634 × 2.8) 4.6-candle power for the 5 cubic foot rate. By actual test with the photometer, we obtain 7.7-candle power for the 5 cubic foot rate per hour. This is an increase of 67 per cent. in the value of the illuminants in the oil gas when burnt in conjunction with marsh gas.

But it may be said that the marsh gas has a candle value of its own. Burned at the rate of 5 cubic feet per hour in a Bray flat flame burner, marsh gas gives 4.5-candle power; and 67 per cent. only of it was used with the oil gas, which would add 3 candles to the value of the

mixtures. As the calculated candle power was 4.6, and the marsh gas added 3 more candles, we thus get a total of 7.6 candles as the value of the two gases, which is closely checked in the photometric test of the mixture (7.7 candle power). It would, therefore, appear that the presence of marsh gas does not increase the value of the illuminants in a mixture, except from the value it adds from its own combustion. But marsh gas also does not nullify candle power in a mixture with oil gas, as seems to happen in the case of the addition of carbon monoxide to oil gas.

The Legal Specifications for Illuminating Gas.

[Prepared for the Seventh Meeting, American Gas Institute, by DR. E. B. ROSA and MR. R. S. MCBRIDE, respectively, Chief Physicist and Assistant Chemist, U. S. Bureau of Standards.]

At the suggestions of certain members of this Institute, the Bureau of Standards undertook several years ago an investigation of calorimetric standards and of flame standards for gas photometry. As the work progressed it became evident that other phases of gas testing were equally deserving of attention; and the field of the investigation was, therefore, extended to include all gas testing work.

As a large part of such testing work is done for the enforcement of gas regulations and for works' control to meet the provisions of law, a study of the laws under which this work is done was an essential part of the problem. The first results of this portion of the work were published last April, as Circular No. 32 of the Bureau, entitled "State and Municipal Regulations for the Quality, Distribution and Testing of Illuminating Gas." It is a review of this phase of the subject which your Technical Committee asked the Bureau to present at this meeting, including a discussion of some contemplated changes. The opportunity to do this is appreciated, as it permits a statement to be made of the method of our work and the spirit and attitude of the Bureau in the investigation.

1. *The Function of a Gas Ordinance.*—Since one of the chief features of a gas ordinance is a specification of gas quality upon which the sale to customers is to be made, it must of necessity involve the question of the price of the gas to the purchaser. Although the Bureau of Standards has not undertaken an investigation of the price of gas, the fact has been borne in mind that all regulations which are adopted must be carefully considered from the standpoint of their probable effect upon the cost and the selling price of gas. Indeed, the question of the quality of gas which is to be required is one which necessitates study, not only from the scientific and technical standpoint, but also from the economic side. The Bureau has endeavored to study and treat it broadly from these various points of view, and in all phases of the problem has striven to give careful and unbiased consideration to all of the facts which bear upon each question investigated, in order to reach correct and just conclusions.

As a regulatory gas ordinance is really a specification accompanying the contract between the gas company and the public, it should clearly define the quality of the gas and gas service which it is expected that the company will furnish to its customers. The standards set by the law should be such that they define without ambiguity those qualities of the gas and gas service which determine the usefulness of the gas to the purchaser. Furthermore, the law or rules should be sufficiently comprehensive to cover all of those points, on which the public can reasonably ask assurance, as to the quality of the gas or the service to be rendered. Because a company is likely without regulation to fulfill certain important conditions, is not sufficient reason for the omission of these conditions from the legal specifications.

It is obviously not possible to lay down rules which will apply alike to all cities and towns in which gas is supplied; but it has been found by the Bureau that a greater uniformity of regulation could be adopted to advantage, and a discussion of the fundamental principles upon which regulatory rules should be based has been one of the objects of our publication.

In the recommendations which have been made by the Bureau, the fundamental idea has been to set forth clearly a review of those subjects which are necessarily covered in a regulatory gas ordinance or law. It is hoped that such an impartial presentation of the subject will enable city and State legislators to understand more quickly and more thoroughly the technical questions involved, and assist them in the enactment of laws which will better accomplish their purpose.

2. *Previous Recommendations.*—It is expected that Circular 32 will be revised and a second edition published during the coming winter. In this revision will appear certain changes from the recommendations of the first edition, with which many of you are more or less familiar; some of the changes under consideration are discussed in this paper. The general provisions recommended by the first edition were as follows:

A double standard has not been recommended for municipal gas control, except for large cities, and no definite expression of preference as to candle power or heating value rules has been given when only one is required. When a lighting value regulation is desired a candle power of 15 for coal gas and 18 for water gas is recommended, using for testing an open flame burner, an open bar photometer and a 10-candle power pentane lamp as standard; but when used with a heating value requirement only a 15-candle requirement appears necessary, even for water gas. A standard value of 600 B.T.U gross per cubic foot of gas was proposed for all kinds of gas. Both heating value and candle power requirements are on monthly averages, deficiency of 2-candle power (or 50 B.T.U. on any day) being allowed without penalty.

The purity requirements proposed follow the usual lines in prohibiting the presence of hydrogen sulphide, as judged by a rather lenient method of test, which is specified; and the ammonia and total sulphur are limited to 5 and 20 grains per 100 cubic feet, respectively, for water gas, or 10 and 30 grains for coal gas.

The limits fixed for pressure are 2 and 6 inches, but the maximum on any day must not be greater than twice the minimum on the same day, as measured at any one service outlet. However, penalty for pressure deficiency is not imposed, except when less than 1.5 inch pressures are found, although less than 2-inch pressures must be corrected within a reasonable time. No opinion is expressed on meter testing as to who should be responsible for this work, but provisions for testing all meters once in 5 years are recommended. State regulations are different in form, but their technical features are very similar to those proposed for cities.

As was suggested in Circular 32, State regulations should not be fixed in a general law, but rather by the State commission operating under a law which gives it the necessary authority; for the same requirements cannot always be fairly made of every company, and under special conditions it may be desirable to depart rather widely from usual values.

Having in mind these general rules, which were in Circular 32, let us consider the basis upon which they are laid and the desirability of certain changes.

3. *Candle Power vs. Heating Value Regulations.*—It is commonly believed that the heating value of a gas is a better measure of the general usefulness of the gas than is the candle power, and for most places there is no doubt that the heating value standard is preferable to candle power regulation when only one of them is used. The objection to the heating value requirement that some experience is necessary to be able to make gas to such a standard with a maximum efficiency, does not appear to be serious. It is evident that a gas maker cannot from the first be expected to make gas with the greatest possible efficiency under new conditions; but the experience of those who have made a fair trial of the methods for works' operation on a heating value standard, indicates that greater economies of operation can be obtained as the details of the new methods are developed. Another practical advantage to the manufacturer is that the losses of heating value of the gas during distribution are much less proportionately than are the losses of candle power; furthermore, abnormal weather conditions are less troublesome when control is on a heating value basis. It seems certain, therefore, that, even from the first, as great economy will result under heating value standards as at present, and that increased experience will permit appreciable improvements over present conditions.

From the point of view of the usefulness of the gas to the customer, there is no doubt that both the heating and the lighting value of the gas should be maintained above certain minimum values. However, some engineers claim that a company should not be required to maintain both candle power and heating value of specified amount, as they believe that, under the present methods of manufacture and with the present day appliances for gas consumption, it is only necessary to regulate one of these qualities and allow the other to be what will correspond, having regard only for economy of manufacture.

At the present time the methods employed in gas making are such that all coal and water gas made on a heating value basis will also have a reasonable candle power; but gases of nearly normal heat value and very low candle power are available; and wherever it is

found practicable to supply these gases at a satisfactory price, the question arises as to how far we may disregard the lighting value of the gas. There are those who say that, if gas can be made cheaper by this procedure, it is proper, even at the present time, to wholly disregard the open flame candle power of the gas. However, the Bureau has taken the attitude that there are still too many who are utilizing gas in open flame burners to do this.

There is some question as to how far the change from open flame to mantle lights can be carried, as there are places for which the open flame burner is better suited than is the mantle light. These places are basements, halls, storage and attic rooms, where the light is little used or where the burner is subject to such rough treatment as to make a mantle impracticable. In combination fixtures, where gas is used only in case of interruption of the electric service, the extra investment in mantle lights is not warranted, even if the mantle burner were adapted for use on combination fixtures, which is usually not the case.

A nominal candle power gas will be sufficient for use in such places as those just mentioned, and without legal candle power regulation the gas made by the ordinary processes of the present day will be satisfactory in quality for emergency use in fixtures, even if only heat value is controlled, since the lowest candle power would scarcely be less than 10 candles if the gas were of 600 B. T. U., or higher. On the other hand, it is uncertain what would be the result if a gas maker undertook to wash the gas with oil or to make considerable modifications in the retort or generator operation. We have not yet reached the time when customers requiring open flame candle power in gas are negligible numerically; nor has it yet been proved that the manufacture of a non-luminous gas is most economical or desirable. We are, therefore, disposed to recommend retaining a minimum candle power requirement as a secondary standard in addition to the more important heating value standard. Such a minimum candle power value should be low enough so that the manufacture of gas is not thereby complicated, and its cost is not increased. No penalty need be imposed for daily deficiency in candle power under these rules, and possibly a slight deficiency in a single monthly average might be allowed without penalty if subsequent averages were above the requirement.

Whenever such methods of operation are devised that the methane content of the gas can be largely increased, we shall be confronted with this problem; and it is not improbable that such process will be devised in the near future. If the time comes when a nearly non-luminous gas is clearly to the advantage of the public, the price would probably have to be readjusted, and in that case the candle power requirement can be readjusted also.

The use of a minimum candle power requirement as described above (say 12 to 15 candles measured in an open flame burner) is not what we understand by a double standard. The latter involves a candle power requirement as difficult to meet as the heating value requirement, so that the company would find it necessary to watch both calorimetric and photometric values daily. This we do not recommend.

Gas can be too rich in illuminants for the best service with mantles, as well as too poor for satisfactory service with open flames. Too high or too low a heating value will be less economical than some intermediate value. A wisely chosen mean, to be clearly specified and carefully maintained, is what is wanted; but this best mean is not everywhere the same, and under special conditions it may be desirable to depart rather widely from usual values. Hence the State commissions should be authorized to fix the values required and to make exceptions for special reasons.

4. *Gross, Net and Total Heating Value Standards. Definitions.*—For a clear understanding of the relative merits of the gross, net and total heating values of gas as standards of specification, it is necessary to define these terms accurately. The gross heating value and total heating value are often used synonomously; however, if we define the latter precisely we find it useful to distinguish between it and the uncorrected measured value commonly called the gross value.

Let us consider what takes place in a calorimeter. Entering the instrument there is: First, gas at room temperature saturated with water by passing through the wet meter by which it is measured; and, second, air at room temperature and room humidity, in quantity determined by the form and the method of operation of the instrument. The gas is burned, forming water and carbon dioxide, with liberation of heat; and the products of combustion are cooled by the water flowing through the calorimeter practically to the temperature of the inlet water. During the cooling, part of the water vapor is condensed to liquid; and the products ot combustion escape carrying just enough water to saturate them at the exhaust temperature. The amount of water condensed is equal to the amount formed in the flame only when the water vapor entering with gas and air equals the water vapor leaving in the products of combustion. If, as usually is the case, less water enters as vapor than leaves in the products, obviously the amount of water condensed is less than that formed in the flame, and *vice versa*. In extreme cases the water required to saturate the products of combustion may be as much as that which enters plus that which is formed by burning the gas; there is then no water condensed. Thus the heat to be measured by the calorimeter, due to combustion in the flame, is made up of two parts:

1. The heat given up by radiation from the flame and by *cooling* the products of combustion to the exhaust temperature.
2. The heat given up by *condensing* water from vapor to the liquid combustion.

If an efficient calorimeter is properly operated all of the heat of burning the gas and cooling the products is measured, together with all the heat of condensation of that amount of water which can be condensed under the existing atmospheric conditions. This heat is that ordinarily measured by a calorimeter and is often called the gross heat; however, we shall hereafter call it the observed heating value, and we shall use the word "gross" as synonymous with total. From the heat measured by the calorimeter that heat which is liberated by condensing the water from vapor at room temperature to liquid at room temperature can be deducted. The value thus obtained is the heat which would have been measured if all of the water had gone out in the products as vapor. This is known as the *net* heat. On the other hand if we correct the observed heating value, so as to include the heat which is lost or to exclude any that is gained, by the fact that the condensed water does not equal that formed in the flame, then the true total heat of the gas is obtained. As the amount of moisture condensed in the calorimeter depends not only upon the quantity produced in the flame by combustion, but also depends upon (1) the amount brought in by the incoming air and gas, and (2) the amount carried out by the products of combustion, we see that the portion of the heat of condensation measured is variable, depending upon atmospheric temperature and humidity and upon the quantity of air entering the calorimeter. Therefore, the observed heating value is not a constant depending only on the quality of the gas, like the total and the net, but varies appreciably. In extreme cases it may be as small as the net or as large or larger than the total. These three heating values of the gas can, therefore, be defined as follows:

The *observed* heating value of a gas is the heat measured by an efficient calorimeter when a unit volume of gas is burned, the air supporting combustion entering the calorimeter at the temperature and humidity of the room and the products of combustion leaving saturated at about the same temperature.

The *total* heating value of a gas, often called the "gross" heating value, is the total heat liberated by the combustion at constant pressure of a unit volume of that gas with air of the same temperature, when all of the water formed in the flame (and no more) is condensed and the products of combustion are cooled to the original temperature.

The *net* heating value of a gas is the heat produced by the combustion, at constant pressure, of a unit-volume of that gas with air was of the same temperature when none of the water formed in the flame is condensed to liquid, but when all of the products of combustion are cooled to the original temperature.

From the observed heating value as above defined we obtain either net or total, the one by a correction depending upon the water condensed in the calorimeter, the other by a correction depending upon atmospheric conditions. It is assumed that this observed value will be free from errors of gas measurement and temperature, and from radiation losses which are preventable by proper operation of the calorimeter.

5. *The Net Heating Value as a Standard.*—Having clearly in mind the relation of the observed, the net and the total heating values, let us consider their comparative values as a measure of gas quality for purposes of legal specification. The three most important considerations then before us are as follows:

1. Which heating value is the best measure of the usefulness of the gas to the consumer?

(*Continued on page* 346.)

THE AMERICAN GAS LIGHT JOURNAL

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NEW YORK, MONDAY, NOVEMBER 25, 1912.

[OFFICIAL.]

National Commercial Gas Association.

OFFICE OF SECRETARY,
NEW YORK CITY, Nov. 22, 1912.

To the Members of the National Commercial Gas Association: The Eighth Annual Convention and Exhibition of Gas Appliances of the Association will be held in the Auditorium Armory, Gilmer and Courtland streets, Atlanta, Ga., December 2d to 7th, 1912.

There is an unusual interest in the meeting this year, and so many advance hotel registrations have been received that a record attendance is anticipated. Every member of the Association who can possibly attend should make a special effort to do so. Gas companies particularly are urged to allow at least one of their commercial men to attend, and as many more as can be spared. These annual meetings have a great stimulating effect upon those in attendance. The opportunity to meet commercial men from all parts of the country, to listen to the papers read, participate in the discussions, view and study all the latest gas consuming appliances, etc., make such a trip of immense value. One important matter to be discussed will be several changes in the Constitution and By-Laws and to provide for company membership.

Every company member should send a delegate to represent the company, offer suggestions which will enable the executive officers to carry on the work of the Association and to increase its usefulness not only to the individual members, but the companies also. Members are requested to bring the ladies and their trip will be made most enjoyable throughout.

Registration. A temporary registration booth will be opened at the Headquarters, in the Georgian Terrace Hotel, on Sunday, December 1st. Registration will continue at the Auditorium Armory, Monday, December 2d. The Exhibition of Appliances will be open for private inspection of the members and their guests on Monday.

Business Sessions.—The opening, and all subsequent, business sessions of the convention will be held in the Convention Hall, located in the Auditorium Armory, beginning Tuesday morning, December 3d, at 10 A.M.

PAPERS.

Monday, A.M. Address of welcome, reports of the Board of Directors, President, Treasurer, Secretary, and Committees, election of new officers, etc.:

Tuesday, P.M. "Gratuitous Work for Consumers, the Reasons, Precautions and Its Remedies," by Mr. E. C. Weisgerber, General Manager Cedar Rapids Gas Company, Cedar Rapids, Ia.

"The Sale of Gas for Illumination," by Mr. R. F. Pierce, Illuminating Engineer, Welsbach Company.

Wednesday, P.M. "Artificial Gas for House Heating and its Possibilities," by Mr. A. F. Krippner, Industrial Engineer, Laclede Gas Lt. Co., St. Louis, Mo.

"Industrial Fuel as a Revenue Producer and Methods for Development of Large Consumers," by Mr. John S. Welch and the Industrial Division of the Philadelphia Gas Works.

Thursday, P.M.—"Efficiency in the Advertising Department," by Mr. E. St. Elmo Lewis, Detroit, Mich.

"Sales Campaigns," by Mr. James P. Hanlon, Public Service Gas Company, Newark, N. J.

Friday, P.M.—"Education of the Employees," by Dr. Lee Galloway, New York University, New York City.

"Public Service," by C. E. Paige, Tenney Syndicate, Boston, Mass.

ENTERTAINMENT FEATURES.

Monday Evening, December 2d.—Informal Reception and Buffet Supper, to be given by Mr. P. S. Arkwright, of the Atlanta Gas Light Company, at the Piedmont Driving Club.

Wednesday Evening, December 4th.—Theater party, Grand Opera House.

Friday Evening, December 6th.—Beefsteak dinner, Taft Hall, Armory.

Saturday Afternoon, 12:30.—Georgia barbecue at the Park avenue entrance of Grant's Park.

Entertainment coupon books—gentlemen, $7.50; ladies, $2.50.

TRANSPORTATION, SPECIAL TRAINS, ETC., TO ATLANTA, GA.

Two special trains have been arranged for, carrying the latest and most up-to-date equipment: One from Chicago and one from New York; also, special sleepers from Cincinnati and New Orleans.

The New York train to Atlanta Ga., will run via Pennsylvania Railroad and Southern Railway The equipment will consist of Compartment Observation Sleepers, Club Car, Open Section Drawing-room Sleepers, Dining Car and Baggage Car. This train will leave New York, Sunday, Dec. 1st, at 3:14 P.M., and will stop at Newark, Philadelphia, Wilmington, Baltimore and Washington, arriving at Atlanta, Monday, Decem ber2d, at 3:30 P.M.

Reservations on this train should be addressed to Mr. H. B. McLean, General Superintendent, Consolidated Gas Co., New York City.

The Chicago train to Atlanta, Ga., will run via Pennsylvania Lines and Louisville and Nashville Railroad. The equipment will be the same as the New York "Special." This train will leave Chicago, Sunday, Dec. 1st, at 4:30 P.M., and will stop at Cincinnati and Knoxville, arriving at Atlanta, Monday, December 2d, at 3:30 P.M.

The Cincinnati sleepers will be in readiness at the Pennsylvania station, Cincinnati, to accommodate members and their friends from Cleveland, Pittsburgh, Columbus, Dayton and Indianapolis, and will be attached to the Chicago "Special."

Reservations on this train should be addressed to Mr. J. E. J. Mayer, Commercial Agent, Peoples Gas Light and Coke Co., Chicago.

The New Orleans sleepers will be attached to the Louisville and Nashville train No. 38, leaving New Orleans at 8 P.M., Sunday, December 1st, stopping at Mobile and Montgomery, and arriving at Atlanta, Monday, December 2d, at 10:45 A.M.

Reservations on these sleepers should be addressed to Mr. G. M. Howsmon, Commercial Agent, New Orleans Gas and Light Co., New Orleans, La.

ATLANTA HOTEL RATES.

Hotels.	Room with Bath.		Room without Bath.	
	1 Person Per Day.	2 Persons Per Day.	1 Person Per Day.	2 Persons Per Day.
*Georgian Terrace (European)	$3 to $4	$4 to $5	$2.00	$3.50
Aragon (European)	2.00 up	3.50 up	1.00 up	2.00 up
Aragon (American)	3.50 up	6.00 up	2.50 up	5.00 up
Dakota (European)	2.00	3.50	1.50	2.50
Empire (European)	1.50	2.50	1.00	1.50
Imperial (European)	3.00	4.00	2.00	3.00
Imperial (American)	5.00	8.00	4.00	7.00
New Kimball (European)	2.00 up	3.50 up	1.00 up	2.00 up
New Kimball (American)	3.50 up	6.00 up	2.50 up	5.00 up
Leland (European)	.....	.....	.....	1.50 up
Leland (American)	...	... ...	.	3.00 up
Majestic (European)	2.50 up	4.00 up	1.50 up	2.00 up
Majestic (American)	3 50 up	6 00 up	2.50 up	5.00 up
Marion (American)	3.00 up	6.00 up	2.50 up	5.00 up
Peachtree Inn (European)	1.00	1.50	0.50	1 00
Peachtree Inn (American)	1 00	1.50	0.50	1.00
Piedmont (European)	2 50 up	4.00 up	1.50 up	2.50 up
Scoville (European)	2.00 up	3.00 up	1.00 up	2.00 up
Terminal (European)	2.00	3.00	1.00 up	2.00 up

*Georgian Terrace: Suites consisting of parlor, bedroom and bath, $10 per day, up.

J. WEAVER SMITH,
Chairman Hotel Committee, Electric and Gas Bldg., Atlanta, Ga.
Make your hotel reservations direct to Mr. Smith.

Respectfully, LOUIS STOTZ, Secretary.

[OFFICIAL.]

November Meeting, Public Service Gas Company (N. J.) Section, N. C. G. A.

To the Members: There will be a meeting of the Company Section (N. J.) National Commercial Gas Association, at 8 o'clock, Tuesday evening, November 26th, in the Assembly Room, Public Service Building, Broad and Bank streets, Newark, N. J. A paper, on "Consumers' Complaints," will be read by Mr. J. P. Zingg, of Montclair. Mr. Zingg intends to put this matter in a light entirely different through which it is generally seen; and I feel assured that it will be a very interesting paper.

Very truly yours,
W. H. PETTES, Chairman.

BRIEFLY TOLD.

OBITUARY NOTE: CAPTAIN WILLIAM STEINWEDELL.—After a career of exceeding length and much accomplishing, death put an end to the mundane time of Captain William Steinwedell, whose summons from earth was served the morning of October 18th, 1912, at his beautiful Quincy home. The finality was the sequel to a long illness, the initial symptoms of which were observed perhaps 5 years ago. And all this privation and pain were borne with the fortitude of the tried, true and lovable veteran that he surely was. For the prior month it was known that he was beyond all human aid, and the end came peacefully at last. Captain William Steinwedell was born, August 29th, 1827, in Hanover, Germany. His father was a Colonel ranking high in the Hanoverian service. Deceased was given all the advantages that a liberal tuition could grant; and it was the fruiting of such tuition that caused him to object to the exactions of those giving their adherence and support to monarchy. So, at the out-

break of the fierce struggle of 1848, he left his native land to cast his fortunes with those in this country, who prefer freedom to supervision. Having knowledge of someone resident in Quincy, Ills., thence he directed his way, reaching that tiny hamlet towards the close of 1848. Having examined the place and its probabilities, with a discernment far beyond his years, he eventually determined to engage there in business, and in 1848 the firm of Bertschinger & Steinwedell was founded, to take on the sale of pig and finished iron, heavy hardware goods and the like. The firm was a success from the start, and it was further notable from the fact that it was one of the first in the West to make direct importations from Europe. The firm continued in business for over a score of years, in fact until the fall of 1873, when, owing to the desire of Mr. Bertschinger to return to his native land, its affairs were wound-up. Of course, Mr. Steinwedell's activities were not confined to the doings of the named firm. He was concerned in manufacturing industries, banks, insurance companies, etc., was one of the organizers of the Quincy Gas Light Company—the school that developed the business genius of his friend and co-laborer, the well beloved "Gus." W. Littleton—and was for over 20 years its President; was an organizer of the Quincy Turnverein, and a builder of the Turners' Hall. In fact, to Mr. Steinwedell, with a few intimates, is due the importance of Quincy to-day in the affairs of the great State of Illinois. This record would be decidedly incomplete were it not stated therein that, during the War of the Rebellion, no more steadfast or contributing representative of the Federal cause, was in evidence. A brief summary of his activity in this connection is: At the outset of the war he organized a local military company, which performed good service in and about Quincy, carrying on the organization without any expense to the authorities. He obtained the money necessary for this undertaking from the La Grange and Canton (Ills.) banks, delivering the same to the St. Louis sub-treasury, to the order of General Fremont. He furnished the escort for 20,000 stand of arms, for Iowa troops from Quincy to Keokuk; relieved the 16th Illinois when it was hemmed in at Monroe City, Mo., by the confederates; and virtually saw service one way or another for 4 years. He was President of the Board of Trustees, Soldiers' Home, from 1894 until 1897. His charities are best denominated by saying that he gave continuously, plentifully and ungrudgingly; and it is also a certainty that no other resident of the city which he did so much to build was held in more esteem or was more beloved. Of course, Mr. Steinwedell was well known to the gas industry through his former membership in the Western Gas Association and through his sturdy sons, W. E., of Cleveland, O.; Carl, of Quincy; and George, of St. Paul, Minn. His other next of kin are two daughters: Miss Elise, of Quincy; and Mrs. F. W. Evatt, of Cincinnati. And the writer of this brief story of a life that more than covered 4 score years, would close the narrative by remarking that Captain Steinwedell was personally known to him for 32 years, and it is his satisfactory province to declare that no better, truer or more lovable man has it been his good fortune to know or with whom to counsel.—C.

GAS RATE DETERMINATION FOR MILWAUKEE, WIS.—The hearing of the application for a reduction of the rates maintained by the Milwaukee Gas Light Company, which hearing was held at Madison, before the Railway Rate Commission, Wednesday and Thursday, November 13 and 14, developed much interesting data tending to show that the contemplated reduction would be vastly disadvantageous to the gas consuming public of Milwaukee. The Company introduced evidence to show that the appraisal of the Commission's engineers was too low; the engineers had placed the reproduction value at $9,841,986, adding 15 per cent. for overhead. Mr. W. H. Blood, of the Stone-Webster Company, Mr. H. A. Carpenter, of the Riter-Conley Mfg. Company, and Mr. Howard Bruce, of the Bartlett-Hayward Company, testified that the overhead should be from 18 per cent. up to 36 per cent. Heretofore the Wisconsin Commission has refused to allow an overhead for public utility corporations in excess of 12 per cent. The Company contended for 18½ per cent. overhead, setting up that a going value of from $2,500,000 to $3,000,000 was fair, because of the high per capita consumption of gas in Milwaukee, the goodwill of the public, and the exceptional efficiency of service rendered to the consumers. Factors to substantiate this claim for high going value were the Company's policy of maintaining high standard of output, anticipating the complaints of consumers, gratuitous inspection of appliances, and frequent reduction in rates, when circumstances warranted. Evidence of this was shown in the fact that the per capita consumption of gas in Milwaukee is 7,360, while the average of a large number of principal cities is 5,190. A mass of tables and graphic charts was introduced to substantiate in every particular the contention of the Company. One of these charts showed that, while the cost of living had risen fully 50 per cent., the price of gas had been steadily going downward, until the maximum in Milwaukee is now less than half of that it was at the time the comparisons were started. The probable continued increase in labor costs, due to shorter working hours and higher wages, increase in cost of gas coal, the curtailment of crude oil output, and the great increase in price of this material, with the necessity for replacement of distribution equipment in the near future, were convincingly laid before the Commission to show that a reduction would be impossible if present standards are to be maintained. City Attorney, Daniel Hoan, introduced no evidence to rebut the Milwaukee Gas Light Company's testimony, relying wholly upon the physical valuation made by the Commission's engineers. * * *

NOVEMBER MEETING, NEW YORK SECTION, I. E. S.—The local Section of the Illuminating Engineering Society and the New York Companies Section of the National Electric Light Association, held a joint meeting, Monday, November 18, in the Edison Auditorium, 44 West 27th street, at 8:15 P.M. A demonstration of lighting effects was made by Mr. Preston S. Millar, of the Electrical Testing Laboratories. Three miniature rooms were shown, with a varied set of equipments, including lamps, shades, reflectors and wall papers of different colors. The demonstration was a great success, and was so voted by both the speakers and others present. The discussion, although meager to the extreme, did bring out remarks from several "prominent" members as called for by the programme. Among those present were Drs. C. H. Sharp and H. E. Ives, and Messrs. N. Macbeth, A. B. Stark, A. H. Hall, H. B. McLean, J. M. Butler, W. A. Root, A. M. Berg, W. H. Spencer and T. Scofield.

NOVEMBER MEETING, PROGRESS CLUB.—The November Meeting of the Progress Club, which is composed of the employees of the Brooklyn Union Gas Company, was held Friday evening, the 15th inst., at the Club Rooms, 130 Atlantic avenue, Brooklyn. The Chairman (Mr. H. L. Denton) who has carried forward the entertainment features of the organization with much success, introduced Mr. H. Thurston Owens, who showed, by means of stereopticon views, the methods in public lighting followed in many important cities of this country and Europe.

Publications.

[All Publications, Catalogues, etc., mentioned below, are kept in our office for the convenience of our patrons.]

"*What We Make.*"—Such is the title of a booklet of 48 pages just issued by the Green Fuel Economizer Company, Matteawan, N. Y. Like everything else that this corporation does, the booklet is well done, both as to get-up and text. Of course, it has to do with the Green Fuel Company's many and useful products. These include fuel economizers, mechanical draft outlets, heating, ventilating and drying outfits, hot-blast heaters, steel plate fans, motor and engine-driven fans, cast iron volume blowers, slow speed and standard speed planing mill exhausters, fan and cone wheels, wooden wheels, ventilator wheels, propellor fans, vertical and horizontal engines, and mechanical draft dampers.

"*Beardslee Talks.*"—A small monthly house organ of the Beardslee Chandelier Manufacturing Company, showing new designs in gas and electric fixtures.

"*Modern Welded Pipe.*"—The processes employed in manufacturing welded pipe, by the National Tube Company, are described interestingly in a handsome booklet. Write for a copy.

"*Welsbach Pamphlets.*"—A number of 3 by 6-inch folders, describing several popular lamps and mantles of the Welsbach Company, may be obtained by writing to the Company at Gloucester, N.J.

"*Charging Cars.*"—Catalogue No. 412 of the Orenstein-Arthur-Koppel Company, describes the Koppel system of cast plate track and charging cars.

"*Curb Box.*"—A telescoping curb box, which covers valve and standpipe, is described in Catalogue "G.," of the S. E. T. Valve and Hydrant Company.

"*High Efficiency Reflectors.*"—Catalogue No. 16 of Gillinder & Sons, covers glass reflectors for gas and electric lamps.

"*Revolving Lamp Display.*"—This "Bulletin," by Winfield H. Smith, covers a revolving lamp display table with equipment for mechanical operation.

"*Station Governors.*"—The complete line of Connelly Station Governors is tastefully illustrated and fully described in 1912 "Bulletin," No. 1.

(*Continued from page* 343.)

2. Which value can be controlled by the gas maker most easily and with least expense?

3. Which value can be determined for purposes of control or inspection with greatest ease and exactness?

(1) At the present time there are no gas consuming appliances in general use which utilize more than the net heat of the gas; and there is no probability that any appliances will be built which will do so, unless it becomes commercially practicable for a water heater to deliver the products of combustion at a temperature much lower than is now done. As there must necessarily be some loss of heat in any practical water heater or other gas appliance, 100 per cent. efficiency on the basis of the total heat is impossible, and we doubt whether 100 per cent. efficiency on the basis of the net heat will ever be surpassed in practice. Room heaters, lighting and cooking appliances and all power producing devices deliver the products at relatively high temperatures (say above 150° F.), so that no moisture is condensed inside the apparatus, and hence can never use more than the net heat. In order to produce the necessary draft the products from any appliance, even a water heater, must escape into the flues at a temperature considerably above the room. The maximum usable heat is, therefore, generally much less than the net heat.

From the above facts it is probable that the maximum efficiency of most appliances will be reached in practice when all of the net heat of the gas is utilized. It thus appears that the net heat most nearly measures the usefulness of the gas to the consumer.

(2) In considering which heat value can be best controlled by the gas maker, there is no evidence to show that the gas maker can control his generation or purification process to better advantage on the one basis than upon the other; but there is one factor which may be overlooked in this connection. If to-day a gas is made of exactly the same chemical composition as that made yesterday the maker would expect that the heating value would be the same. However, if a considerable change in humidity has occurred, the observed heating value of the gas as measured on the second day may be as much as 10 or 15 B.T.U. higher or lower, even assuming that perfectly correct observations be made in the measurement of it. Now if the value of the gas varies appreciably when on an observed heating value basis, due to the weather, the gas maker would find exact works' control less easy on that account. Although it is not possible to control manufacturiag processes perfectly, unnecessary uncertainties should not be encouraged.

(3) For the consideration of the relative accuracy of the determination of the three heating values, we must again consider the factors which influence each. In the first place we have errors in observation of gas volume, water temperatures, and gas temperature or pressure, all of which errors have the same effect upon each of the three heating values. In this respect they are on a par. The efficiency of the calorimeter as an absorber of the heat also has no influenc upon one that is not also true of the other two as well, and the failure properly to cool the products of combustion has an equal influence upon each value as far as it affects the sensible heat in the products of combustion. On the other hand, the amount of water entering and leaving the calorimeter in the vapor state has a very different effect upon the different values.

The amount of moisture which enters the instrument is determined by the amount of the air entering and its moisture content; and the amount of water leaving as vapor is determined by the quantity of the products of combustion and their temperature of saturation. For a correct determination of the total heat it is necessary that all of the water formed by the burning of the gas be condensed in the calorimeter and that all other water entering the instrument be discharged as vapor. To produce this condition it is evident that the water entering in the gas and air as a vapor must be adjusted so that its amount is equal to that in the products of combustion; and, furthermore, as the products always leave the calorimeter saturated with water vapor at their outgoing temperature, it is necessary that the air and gas entering the calorimeter bring in just enough water to accomplish this saturation of the products. Now this adjustment is obviously one which cannot be exactly made unless the water vapor content and the quantity of the air entering be known. From a practical standpoint, there is no convenient way by which the water entering the instrument can always be made equal to the amount leaving the instrument. The problem has become one of adjusting the conditions of the test so that the difference shall always be a minimum.

To illustrate the problem by an example, we will take a gas of total heating value of 600 B. T. U. per cubic foot, and of net heating value of 550 B. T. U. per cubic foot. If this gas is burned in a calorimeter with about 6 volumes of air which is 90 per cent. saturated with moisture and at 70°, we would find the following conditions to hold:

Water entering with 1 cubic foot of gas (being saturated by passage through the wet meter at 70°)	0.5 gram.
Water entering with 6 volumes of 90 per cent. (saturated air at 70°)	2.7 grams.
Water formed by combustion (equivalent to 50 B. T. U. difference between total and net as assumed above).	21.7 grams.
Total entering and formed	24.9 grams.
Water leaving in products of combustion[1]	2.75 grams.
Difference or water condensed in the calorimeter	22.15 grams.

1. The products of combustion are assumed to be at the room temperature and saturated at this temperature. Their volume is in all cases of coal, water or mixed gas practically equal to the volume of the air entering less one-half of the volume of gas entering. The contraction is due to the condensation of the water formed in the flame. To calculate the water in the products, the following method is employed: Multiply the volume of air less one-half the volume of gas by the amount of water required to saturate one volume of products at the temperature of the exhaust. Use has been made here of both metric and English units to correspond with usual gas laboratory practice, although rather an unscientific combination results.

Under the conditions assumed for this test more water is condensed in the calorimeter than is formed in the flame; the heat of condensation of this excess being measured, the observed value will be higher than the total by the amount equivalent to this excess of condensed water, or 1 B.T.U. above the total value.

If under other conditions of test 9 volumes of air were passed for each volume of gas burned, and the room was at 80° and the air 30 per cent. saturated, we should find an observed value of only 592 B.T.U., or 8 B.T.U. below the total. Considering the conditions which exist in the laboratories of this country, it is evident that there would be variations (apart from errors of observation) such that gas of 600 B.T.U. total heating value would show from 605 B.T.U. to 585 B.T.U., or less.

On the other hand, when the net value of the gas is measured there is no need to consider the influence of humidity or quantity of air flowing through the calorimeter. If, as in the examples given above, the condensed water were too great or too small, the water corrected for in determining the net would be correspondingly larger or smaller. The net value resulting is, therefore, in each case automatically corrected to its true amount, every increase in observed value being counterbalanced by increase in the correction for getting the net value and vice versa. The following conditions affect the observed value even when the calorimeter is correctly operated, but do not affect the net value: (1) Humidity of room; (2) room temperature; (3) rate of gas consumption; (4) position of damper and temperature of exhaust (this last does affect the net slightly, but much less than the observed).

The only measurement required for determination of the net, not also required for the observed, is the measurement of the quantity of water condensed during the burning of a cubic foot of gas. This observation is easily made with such exactness that no errors greater than 2 B.T.U. (equivalent to 1 cc. of drip per cubic foot of gas burned) are to be expected.

It is possible that leaks from the water circulation chambers into the flues of the calorimeter would occur and render the drip collected too great in amount. One or two inspectors have noted such leaks; but the majority of calorimeter users seem to have experienced no difficulty in this way. If they occur such leak would render net values incorrect, but would affect the observed values only slightly. Apparently this error need not be considered as a serious factor, except possibly in travelling calorimetric work for State inspection; and here a simple test will show whether the calorimeter leaks.

6. *The Total Heating Value as a Standard.*—In the rules adopted by the four State Commissions which have made heating value regulations, the requirement is made that the "total heating value" be above a specified standard; however, in the 30 or more cities having heating value limits in ordinances, we have found no city which specifies the total heating value. Nineteen of these 30 cities do not state precisely what is intended; 8 specify "gross" value; 2 require "net;" and one states the requirement in terms of "low value," probably meaning net.

In laboratory methods and in technical discussions the observed value as measured is generally used; and in endeavoring to get the

highest value possible, the so-called "maximum efficiency," the calorimeters have been so operated that the measured value has usually come very near indeed to the total. Moreover, by the application of a small correction, which can be taken from a table of corrections when we know the atmospheric humidity and the room temperature, it is practicable to correct this measured value to the total. In routine testing under average conditions this correction may be ignored; but under usual conditions, or when accurate results are desired, it can easily be applied. The magnitude of this correction will, of course, depend upon the quantity of air passing through the calorimeter; but if a calorimeter has been calibrated and is used in the manner prescribed, there will be so little variation in the quantity of air that the uncertainty in the correction will be negligible. At the worst it will be much less uncertain than the uncorrected value.

One method for the direct determination of the total heating value has been proposed; namely, to vary the temperature of the ingoing water so that the products of combustion will escape at such a temperature that the quantity of water vapor carried out of the calorimeter shall be equal to that entering, and thus the heat measured will equal the total. This procedure, of course, requires a knowledge of the atmospheric humidity. Unless the gain in heat from the room were taken into account, which was not suggested in the above proposition, the error introduced would be greater than the error to be corrected for. At best it amounts to making the necessary correction in a somewhat clumsy way by experiment, instead of taking it from a table of corrections and adding it to the measured value.

If, therefore, the total be used as the standard value for testing purposes, we recommend the use of a table of corrections, such as given later. Owing to the water carried into the calorimeter with the gas, and the contraction of the total volume due to combustion, the entering air should not be saturated; if 7 volumes of air are used and the air enters at 80 per cent. relative humidity and leaves at 100 per cent., the water condensed will be exactly equal to the water formed in the flame. In other words, 80 per cent. humidity will be a standard atmospheric condition requiring no correction for the total; the table will then give the correction for the difference between the actual relative humidity and 80 per cent. At 10 per cent. humidity, such as often occurs indoors in winter weather, the correction to be added to the measured value varies from 4.8 B.T.U. at 65° to 10.5 B.T.U. at 90°. If the air enters saturated, the small correction is to be subracted. At 9 volumes of air the correction is larger.

On the other hand, if the heating value be measured by a bomb calorimeter, or by one of the Parr type, the total heating value is observed directly, there being no correction necessary for the loss or gain of heat of condensation. However, with the bomb calorimeters the heat of combustion at constant volume is measured and this must be corrected to heat at constant pressure. It may also be possible that, by the use of an air saturator, the total value can be directly measured in a gas calorimeter of the usual Junkers type; but an apparatus for saturating or making the humidity of the air constant has not yet been proved to be a practicable attachment to a calorimeter.

7. *Net or Total. Which Shall be Used as a Standard?*—Let us briefly restate the merits of these two standards, either of which can be used satisfactorily.

1. The net heat is, on the whole, probably the best measure of the usefulness of the gas to the consumer; it depends only upon the quality of the gas, being unaffected by atmospheric conditions at the time of test, and is easily measured experimentally.

2. The total heat is the value specified in 4 State laws, and is the value probably intended in all other laws which say "gross" value, or which do not specify which standard is meant. It is apparently the value which has been sought for in defining conditions of testing and where "groes" is used in practice it is usually taken to be synonymous with total. The total heat depends only upon the charter of the gas, and can be obtained from the measured value by the use of a simple correction. For ordinary work the observed heat value of coal gas, water gas or mixed gas is within 2 per cent. of the total value; and unless greater accuracy than this is required, no correction to the results of the regular test is desired. When the small discrepancies of observed values are of importance they can be eliminated without difficulty by correction to the total, using a tabular correction as given in Table I.

The examination of the records for a large number of cities scattered over the country shows that the mean atmospheric condition is probably represented by 40 per cent. relative humidity at 70° F., the air then carrying 1 per cent. by volume of water vapor. Hence, if we correct the measured heat by means of a table to the total heating value, we can obtain a value which would be higher than that obtained at the mean humidity.

TABLE I.—*Corrections to Observed Heat to Get Total Heat Value. Air, Gas and Exhaust Must be at the Same Temperature.*

A. If 7 volumes of air per volume of gas are used.

Room Temperature, Humidity, Per Cent.	65°	70°	75°	80°	85°	90°
10	+ 4.8	+ 5.7	+ 6.7	+ 7.9	+ 9.2	+ 10.5
20	+ 4.1	+ 4.9	+ 5.7	+ 6.8	+ 7.8	+ 9 0
30	+ 3.4	+ 4.1	+ 4.7	+ 5.6	+ 6.5	+ 7.4
40	+ 2.7	+ 3.2	+ 3.7	+ 4.5	+ 5.2	+ 5.9
50	+ 2.0	+ 2.4	+ 2.8	+ 3.4	+ 3.8	+ 4.3
60	+ 1.3	+ 1.6	+ 1.8	+ 2.2	+ 2.5	+ 2.8
70	+ 0.6	+ 0.8	+ 0.8	+ 1.0	1.2	+ 1.2
80	— 0.1	± 0.0	— 0.1	— 0.1	— 0.1	— 0.3
90	— 0.8	— 0.9	— 1.1	— 1.3	— 1.5	— 1.9
100	— 1.6	— 1.8	— 2.0	— 2·4	— 2.8	— 3.4

B. If 9 volumes of air per volume of gas are used:

10	+ 6.7	+ 7.9	+ 9.2	+ 10.8	+ 12.5	+ 14.5
20	+ 5.8	+ 6.8	+ 8.0	+ 9.3	+ 10.8	× 12.5
30	+ 4.9	+ 5.7	+ 6.8	+ 7.8	+ 9.1	+ 10 5
40	+ 3.9	+ 4.7	+ 5.5	+ 6.4	+ 7.4	+ 8.5
50	+ 3.0	+ 3.6	+ 4.3	+ 4.9	+ 5.7	+ 6.5
60	+ 2.1	+ 2.5	+ 3.0	+ 3.4	+ 4.0	+ 4.5
70	+ 1.2	+ 1.4	+ 1.8	+ 2.0	+ 2.3	+ 2.5
80	+ 0.2	+ 0.4	+ 0.5	+ 0.5	+ 0.6	+ 0.5
90	— 0.7	— 0.7	— 0.7	— 0.9	— 1.1	— 1.4
100	— 1.6	— 1.8	— 2.0	— 2·4	— 2.8	— 3.4

To use such a value does away with the fluctuations, which under unusual conditions are important, but gives a value which will not be in exact agreement with the mean of a large number of determinations made under a great variety of atmospheric conditions. In other words, if this procedure is adopted, the present names gross and total will be continued, but the present mean value of the standard will be slightly changed. It is, in effect, a lowering of the standard by about 3 B. T. U., a change which might be objected to on principle, even though it is small.

This change, however, is smaller than the change which will result in the heating value effectively required if certain changes in the operation of the Junkers type of calorimeter, proposed by Messrs. Waidner and Mueller, be adopted. In their very thorough study of gas calorimeters at the Bureau of Standards, these investigators have found that the effect of stem corrections of the thermometer readings and radiation losses not heretofore taken account of in gas calorimetry have caused the measured heat values to be from 2 to 3 per cent. too low (10 to 20 B. T. U.). In order to make calorimetric measurements correct, these sources of error should be eliminated and the gas given its true value.

The effect of so doing, however, will be to make existing standards less severe by 10 to 20 B. T. U. Whenever a heating value is being adopted far the first time, or when the price of gas is being readjusted, this change will, of course, be taken into account. But where a heating value is now required by law there may be a question as to whether the same numerical value is to be required, or such a value as to provide an equal quality of gas. Fortunately, in most cases the companies are now furnishing a little better than the minimum requirement, so that this question will not in practice be as acute as otherwise.

In some cities the 2 or 3 per cent. variation just mentioned, which will favor the gas companies, will be needed in some cities to counterbalance the effect of reduced barometric pressure which will be discussed presently.

If it be objected that to apply these corrections in order to obtain the heating value of the gas more accurately, will make the calorimetry of gas much more difficult, the answer is that anyone competent to conduct the experimental part of the work, and obtain satisfactorily the uncorrected gross, is also competent to apply the corrections; for they will be taken from simple tables of corrections prepared for general use, and the process will be a routine one after the observations are completed.

8. *Minimum Values and Monthly Averages.*—For purpose of official specification the monthly average heating value and monthly average candle power of the gas have been recommended by the Bureau. The use of monthly averages has been practiced for some

time, in the case of heat value; but, as far as we can learn, no city or State had adopted a monthly average candle power before the time when this was recommended by the Bureau. The advantage of averages as a basis for specification is obvious to all who know of the difficulties in making an exactly uniform product. The disadvantage to the user of gas has not always been so clearly recognized. The gas which from day-to day, or from hour-to-hour, has the least variation in candle power, heating value density and, most important of all, pressure, is the gas which gives to the consumer the most satisfactory service. Large variations in quality, density and pressure are certain to render unsatisfactory a gas which on an average may be very good in quality or pressure. Minimum allowable values for any one day must, therefore, be specified.

The allowance of a deficiency of 2 candles in the candle power of any one day, is not unreasonable if the gas maker does not attempt to take undue advantage of this tolerance, which is intended to provide for unusual conditions of weather or accidents beyond the control of the company. It is expected that reasonable efforts will be made to keep the gas up to the average value required.

At the present time it is customary to allow a deficiency of 50 B.T.U. in the heating value on any single day below the standard specified. This allowance is probably too great for the best service, as such irregularities as may thereby result do not permit the most satisfactory utilization of the gas. It is expected that after a few years more of experience in making gas on a heat unit basis its makers will be able to secure greater uniformity, but for a while it seems best to permit an ample tolerance. Whether a closer legal restriction will be found necessary is uncertain; for, without legal restriction, the gas maker will naturally endeavor to maintain the most uniform gas possible, since this contributes not only to better service but also to greater economy in manufacturing.

9. *Standard Conditions for Gas Measurement.* — In the First Edition, Circular 32, a cubic foot of gas was defined as follows:

"Unless otherwise provided, a cubic foot of gas shall mean that amount of gas which occupies the volume of 1 cubic foot under the pressure of 30 inches of mercury, and at the temperature of 60° F., when saturated with water."[1] This definition follows the usual practice in correcting all gas volumes measured in connection with testing to seal level conditions; but for purposes of gas specifications it is not in all respects satisfactory.

In the specification of a product to be delivered under contract, it is customary to state the minimum quality and the exact quantity of the product to be delivered. In the case of gas the purchaser is concerned with the average and the minimum quality of gas delivered to him and its quantity; and there is no need for him to know what would be the quality and quantity if he were living at a lower altitude or in a colder climate. When he pays $1 for 1,000 cubic feet of gas as registered by his meter, he is interested in the number of heat units received for the $1; and the gas ordinance should be so drawn as to show this as nearly as practicable. The number of heat units contained in the gas depends, of course, upon its quantity and quality—that is, upon the mass of gas contained in a cubic foot and its chemical composition. If the meter is correct, it depends, therefore, on the density of the gas and its composition, and as the density of the gas varies with the temperature and pressure (as well as with its composition) we see that temperature, pressure and chemical composition are the 3 factors which determine the heating value of the gas. Instead of determining the quality of the gas by means of a chemical analysis, however, the heating value is determined by means of a gas calorimeter; and as the heating value is measured under conditions similar to those under which the gas is burned by gas consumers—that is to say, under the prevailing barometric pressure and at ordinary temperature—there is no need for measuring either the temperature or the pressure, or of applying any correction for either, if they are the same as the mean temperature and pressure of the gas as it is delivered and metered.

There is, of course, considerable variation in the temperature of the meters of a city at any given time, but it is not practicable to measure the temperature of each meter nor to determine the actual average of all. Hence in the past, and for the future until something better is possible, a standard temperature of 60° F. is assumed to be the average temperature, and if the gas passes through the test meter when calorimetric or photometric measurements are being made at a temperature different from 60°, it is proper that correction be made to this temperature, as is ordinarily done.

1. The usual scientific standard is, however, 760 mm. of mercury pressure and zero degrees Centigrade.

With respect to the other factor affecting the density of the gas—namely, the pressure—there are 3 important differences from the question of temperature. In the first place, the barometric pressure is substantially the same everywhere, both in-doors and out-of-doors, in a given city at a given time. In the second place, unlike the temperature, its mean value in a given place is or may be very accurately known. In the third place, there is a far greater effect due to variation from the mean of the average pressure in different cities than due to the variation of the average temperature from 60°. The Weather Bureau has published the annual and monthly averages for so many places, and the variation due to altitude is so well known, that it is a very simple matter to ascertain the average barometric pressure for any place whatever. It is, therefore, neither necessary nor proper to assume that the pressure of the gas in the meters is everywhere the same, as is done for meter temperatures; but the just and proper method is to take, as the normal pressure at any given place, the actual average barometric pressure of that place. For example, suppose that the ordinance of a particular city states that, in all measurements of gas in connection with either calorimetric or photometric testing, correction shall be made to 60° F. and 29 inches of mercury (supposing the latter to be the actual average barometer pressure). All calculations are made just as easily as to 30 inches and the result is correct and just. Therefore, the ordinance definition may be as follows:

"For purposes of testing the quality of gas as provided for herein, a cubic foot of gas shall mean that amount of gas which occupies the volume of 1 cubic foot at 60° F. when saturated with water at this temperature and under a pressure of .... inches of mercury, which is taken as the mean barometric pressure of this city."

The readings of station meters, as well as customers' meters, would require no correction for barometer, either in determining the gas unaccounted-for or in comparing the results of operation of two different cities; for, if gas is measured in the station meters, the test meters and the customers' meters in cubic feet at the prevailing barometric pressure, all results are comparable (in any one city and between different cities) without taking account of the height of the barometer.

Moisture in the Gas.—As measured for testing by a wet meter, the gas is practically [saturated with water at the temperature of the experimental meter, and in the reduction of the measured volume to 60° F., it is customary to correct for the difference in the amount of water in the gas saturated at test meter temperature from that required to saturate the gas at 60° F. This correction is included in the tabular number as given by most texts on calorimetry or photometry, so that with the correction which is ordinarily made we have the volume corrected for differences in humidity.

The gas delivered to consumers varies in moisture content, being saturated with water at the lowest temperature to which it has been brought during its travel through the mains. If we assume that on an average through the year, this lowest temperature is 60° F. then the gas will average about 1¼ per cent. by volume of water vapor; and it is proper to correct the gas tested to the same condition. Even if the average minimum temperature of exposure of the gas was 50° F. the water content would average 1¼ per cent. by volume; and it is, therefore, evident that the rating of the gas at 60° saturation makes only 3 B.T.U. difference from the rating at a 10° lower saturation temperature. On the same basis that we accept the 60° F. as average meter temperature for all places, we assume the same water content for the standard condition in all. Indeed variations from the average are of very little importance as affecting the gas rating.

10. *Reduction of Candle Power Measurements.*—The taking of gas candle power, according to the present procedure, consists in the comparison of the light from a gas flame burning approximately 5 cubic feet of gas per hour with the light from a standard flame, the value of which is fixed for some standard condition of barometer and humidity. This method assumes that the percentage effect of these atmospheric conditions upon the 2 flames is the same, and for want of exact knowledge on this subject this assumption is necessary.

Pentane lamps are standardized at the Bureau of Standards by comparison with incandescent electric standards and rated in international candles at a normal humidity of 8 liters of water vapor per cubic meter and 76 centimeters of mercury barometric pressure. They are used in testing gas at various barometric pressures and humidities, always, however, so far as we know, using their standard, sea-level candle power; if, however, the humidity is higher or the barometric pressure lower than normal, the candle power of the standard pentane lamp will be less than its certified value.

So far as the variation of humidity is concerned, this practice is rational and satisfactory. The gas company is not responsible for the variation in the humidity, and does not profit or lose by it in the long run when gas is tested in this way. The candle power of the standard will be higher when the humidity is less and lower when the humidity is greater, and, on an average, cannot be far from the normal value given for 8 liters of water vapor per cubic meter.

In the same way, fluctuations of the barometer, associated with changes in the weather, cause the light given by the pentane lamp to fluctuate, but these fluctuations cancel out on the average, if the average value of the barometric pressure be used. If, however, the value of the candle power, at 76 centimeters of mercury, is always used when the average barometer is appreciably lower than this, there will be a constant error introduced, corresponding to this constant difference in the barometer. For example at any place where the mean barometer is 24.72 inches, the corresponding candle power of a pentane lamp, having a value of 10 candles at sea level, is 8.67 candles.[1] If, therefore, a pentane lamp, giving on the average 8.67 candles, is taken as 10 candles, the gas is overated in proportion; that is, about 15 per cent.

In addition to this overrating, however, it is customary to introduce an additional correction, due to the fact that gas at the higher altitude has a lesser density than at sea level, and the measured candle power is multiplied by the ratio of the normal barometer to the local barometer; *i. e.*, in this case the measured candle power is multiplied by the fraction $\frac{30}{24.72}$. For example, suppose that in testing gas in such city against a pentane lamp, with the flame burning at the rate of 5 cubic feet per hour, we find it to have a candle power 1½ times as great as the pentane lamp. Rating the latter as 10 candles, the gas will be said to have a candle power of 15 candles. Introducing the correction for pressure, by multiplying 15 by the fraction $\frac{30}{24.72}$, we have 18.2 candles as the value which would be assigned to the gas. In reality, however, the flame is giving only 1.5 times 8.67, or 13 candles, so reporting it as 18.2 overrates it 5.2 candles. This error of 40 per cent. is introduced: First, by assuming the lamp to have a candle power about 1.3 candles greater than it really has; second, by introducing a correction which gives the increase in candle power which the flame would give if it were burned at sea level, assuming that the light would increase in proportion to the increase in the density of the gas. This method is both wrong in theory and misleading in practice. The gas is sold at so much per 1,000 cubic feet, measured at the prevailing barometric pressure of the city, and its candle power, which is measured under the same conditions, should be taken as measured, and should not be reduced to sea level nor to any other conditions not realized at that place. In the case of a city, which is 1,000 feet above sea level, the mean barometer is 28.82 inches, and the error introduced in the testing of gas in this way is more than 6 per cent. (the error in the heating value being 4 per cent.) At an altitude of 10,000, the error introduced in this way is more than 100 per cent. Gas regulations should be written so that the value assigned to the standard used, whether it be a candle, a pentane lamp or other standard, should be its average value as nearly as practicable, corresponding to the mean barometric pressure of the place where it is used.

If this procedure is adopted the Bureau of Standards would, after making some further investigations on the variation of candle power with barometric pressure, certify a pentane lamp for the particular altitude at which it was to be used, in addition to giving its sea level candle power.

In order to show clearly the effect of reduced barometric pressure on the candle power and heating values, found for gas by existing methods of testing, we have prepared Table II. In the first column is given the actual candle power of a gas flame, if tested by comparison with a pentane lamp at various altitudes, in each case reported to be 16 candles. In the fourth column the corresponding heating values are given, supposing the gas always such as to give 600 B. T. U. at 30 inches barometric pressure, hence by the present method of calculating the result the heating value would be reported as 600 in each case.

In what has been said above no criticism is intended of any gas company for following the current practice of ordinary calorimeter and photometric measurements; but it is believed that this practice should be abandoned as soon as possible, and, as suggested, the gas tested under the same conditions as those under which it is sold.

11. *Candle Power Test Burner.*—It is customary to refer to gas as having a certain candle power, without any statement as to the method of the test. However, gas has no constant luminous value corresponding to the heating power of the gas. The quantity of light given out in burning the gas is largely dependent upon the character of the burner; whereas the heat given out in burning the gas is the same in any burner, assuming complete combustion. From the above facts it is evident that a candle power specification should not be made without stating what burner is to be used. In choosing a candle power test burner the following facts should be taken into account:

1. The primary object of a candle power requirement should be to afford protection to users of open flame burners.

2. The best way in which the usefulness of the gas for open flame lights can be obtained is by testing the gas in an open flame burner.

3. The open flame candle power of a gas may be higher or lower than the Argand candle power, according to the kind of gas; hence the candle power required should be varied according to which test burner is used, and the burner specified. The use of the phrase, "the burner best suited to the gas" or any similar phrase, is indefinite and should be avoided.

TABLE II.—*Actual Quality of Gas Rated* 600 *B. T. U. and* 16 *C. P.*
Effect of Altitude in Gas Rating.

Actual Candle Power.	Altitude, Feet.	Barometer, Inches.	Actual Heat Value, B. T. U.
7.6	10,000	20.70	414
8.4	9,000	21.47	429
9.1	8,000	22.38	445
10.0	7,000	23.11	462
10.9	6,000	23.98	480
11.6	5,000	24.91	498
12.4	4,000	25.81	516
13.3	3,000	26.78	536
14.2	2,000	27.78	556
15.0	1,000	28.82	576
15.4	500	29.35	587
15.9	S. level	29.90	598
16.0	100	30.00	600

Note.—The average altitude of 45 of the largest cities of the U. S. is about 500 feet.

On the above basis the Bureau recommends that testing regulations should specify that the candle power of the gas be measured with an open flame burner, a different burner, of course, being used for acetylene and Pintsch gas than for ordinary illuminating gas.

12. *Sulphur, Ammonia and Hydrogen Sulphide.*—The reasons for the limits which are proposed for sulphur, ammonia and hydrogen sulphide, have been discussed in the First Edition of Circular 32. There is nothing in those proposals which seems to require explanation at this time, except the reason for the retention of the ammonia limit in the law, and the basis upon which different values have been set as to amount of ammonia and sulphur allowed in coal gas and water gas.

The retention of the ammonia limit in the law has been criticised on the ground that it is unnecessary; that gas companies will remove this impurity because it is too valuable to lose. This is true of probably over 90 per cent. of the gas companies, and these need not be worried by the retention of the limit; but even at the present time some companies do not remove the ammonia with sufficient care. It is said that for its own protection a company must remove the ammonia or it will ruin its meters; but if this happens the gas consumers will ultimately bear the expense. It is, therefore, best to retain the limit, even though it is probable that without it the results would be the same. If it is retained there is no question as to what the company is expected to do.

With the fuel supplies which are available at the present time coal gas cannot be made as low in ammonia and sulphur compounds, other than hydrogen sulphide, as can water gas. There is no difficulty in maintaining the ammonia and sulphur in water gas below 5 and 20 grains per 100 cubic feet respectively; and the public should be assured by proper regulations that these limits will be observed. In the case of most coal gas plants the same limits would be possible for ammonia as are used for water gas, and in these plants a 5-grain limit would be proper; but in a few coal gas plants it may be necessary to permit as much as 10 grains. In order to provide for these cases we have set the general limit for ammonia at 10 grains.

The sulphur limitation in coal gas manufacture becomes in effect a limitation upon the quality of coal purchased. It is desirable, therefore, that the limits set be not unduly severe, lest a coal which otherwise would be very economical for gas making may be excluded; but some limit should be in force to exclude an unnecessarily high sulphur gas. The public has a right to demand, and should be assured of, the lowest quantity of sulphur and ammonia practicable. To accomplish this without placing undue burden upon coal gas makers, the different standards for coal gas and water gas have been sent.

13. *Composition of Gas.*—From the standpoint of the consumer it is immaterial what the chemical composition of the gas is, as long as it contains no injurious constituents and possesses the specified heating value and candle power; hence, no specification as to the quantity of oxygen, nitrogen and carbon dioxide should be made. The limitation of carbon monoxide, which is sometimes urged, is based upon the fact that it is poisonous, being the only poisonous constituent of illuminating gas; but, inasmuch as illuminating gas cannot be made commercially without containing a considerable percentage of carbon monoxide, it is impracticable to set limits upon it unless the manufacture of water gas is to be forbidden, which seems economically impossible. Hence the Bureau recommends that, instead of attempting to restrict the quantity of CO in the gas, that its danger be mimimized by educating the public in the use of gas and gas appliances, and that gas appliances be improved and their use and installation be studied with a view to securing perfect combustion, good ventilation and the minimum of danger.

14. *Pressure of Gas.*—The great diversity of opinion on the subject of regulations affecting the pressure of gas supply has made generalizations on this subject most difficult. However, the recommendations which were made by the Bureau, as to the minimum and maximum pressures and allowable variations, were very conservative, as shown by evidence which has been presented since the publication of the circular. For later editions the investigation and discussion will be extended along several lines, particularly those suggested in

1. This value is taken from the paper by Butterfield, Haldane and Trotter. *Journal of Gas Lighting*, Vol. 115, p. 288; 1911.

the report made by Mr. W. A. Baehr to the New York Public Service Commission, First District.

15. *Meter Testing Requirements.*—There is little to add at present to the discussion of meter testing requirements in the First Edition of Circular 32. The question of frequency of re-inspection of meters is always an open one; but since publication of the circular no evidence has been submitted to the Bureau to indicate conditions warranting a change from the former recommendation.

The Bureau of Standards is considering all of these subjects in a very conservative and careful manner. We are calling attention to the facts as we understand them, and are inviting discussion and a comparison of experiences. We are taking account not only of experience in our own laboratories, but in other laboratories as well. The Bureau invites written expressions of opinion and experience from any one interested, with the hope that a judicial and open-minded consideration of such suggestions and of all the evidence may result in a satisfactory decision as to what we shall recommend. Our recommendations are, of course, not binding anywhere, but they are made as carefully as though they were.

We wish to express our thanks to the officers of the American Gas Institute for the opportunity to bring before you some of the results of our study of the subject of the legal specifications for the quality of gas and gas service, and also for the cordial co-operation and assistance given this work by many of your members. It is our aim to be of service to the industry as well as to the public, and we welcome suggestions and criticisms which are intended to assist us in reaching correct conclusions.

New Methods and Appliances.

THE OVERREADING OF A GAS METER: A CASE IN POINT.—Mr. Alfred F. King, in a communication to the November issue of the "Baltimore Gas and Electric News," thus interestingly narrates the facts: Recently an interesting and unusual case was brought to my attention. A customer received a gas bill which was largely in excess of that for the previous month, notwithstanding that she had temporarily discontinued the use of her gas range and water heater and had used gas only for illumination. Investigation showed that the meter had been overread 10,000 cubic feet. The customer was informed of the actual index of the meter and was told that the bill should have been for the actual amount of gas registered, not for the incorrect reading charged on the bill sent by the Company. Unfortunately, the customer, as a result of the interview, did not understand that from the nature of things the overreading of a gas meter is mechanically corrected by the meter itself. At the most, it results merely in a payment in advance of actual consumption of gas, as will be explained later.

The Company (Consolidated Gas, Electric Light and Power) has in use in Baltimore 108,467 gas meters which are read monthly. It is the earnest endeavor of the meter reading department to exercise constant care in reading the indexes of the meters. In addition to this care and as a further check upon the accuracy of the bills rendered by the Company, the meter readers' hand books are examined and all abnormal increases or decreases are investigated by the complaint department, which examines the ledger for the corresponding of previous years and in many instances by inquiry on the premises. The checks are applied before the bill is rendered. Notwithstanding the case of meter readers and the checks applied to the system, a bill was rendered in this case for 10,000 cubic feet in excess of the actual reading of the meter dial. During the month, between September 17th and October 17th, the gas registered by the meter was 8,200 cubic feet, and the meter reader incorrectly took the reading as 18,200 cubic feet. This occurred in the following manner:

The meter reader's hand book showed the previous month's reading to be 807. The meter having passed 8,200 cublic feet of gas in the interval, the actual reading of the dial was 889. The meter reader, however, set this down as 989. This made an overcharge of 10,000 cubic feet. It will at once be seen that the meter itself had correctly recorded the gas passed and that the error was purely clerical. It is in fact mechanically impossible for the meter dial to record erroneously when the meter accurately measures the gas passed. All gas meters, before installed, are tested for accuracy both by the Company and the Public Service Commission.

Under ordinary circumstances this difference would be noted and investigation made before the bill in rendered, which would disclose overreading of the meter and cause the bill to be made out for the proper amount. However, should the error continue until it found its final place on the bill in the customer's hand and the customer paid the bill, the matter would be still automatically adjusted, for the overreading of a gas meter is in the course of future readings automatically rectified. Gas bills are figured by subtracting from the current reading of the meter the reading of the preceding month, and in the event that the reading for the preceding month was excessive, the subtraction of the largest figure would give an amount which would automatically adjust the difference between the company and the customer.

In the event that the consumption for the current month would not be as great as the amount overcharged, due to overreading, the meter reader would at once discover the error and by reporting it to the superintendent of his department have the matter corrected. In this event a check would be forwarded to the customer for the amount paid in excess on the previous month's bill and a corrected and receipted bill delivered for that period with the check.

The mechanical accuracy of the gas meter enables it to perform a highly useful service. Placed in the home of each customer of the Company it correctly and plainly records the quantity of gas that is being used. The Company urges its customers to read their meters and to keep tab on their gas bills, as they do on other bills, and for this purpose furnishes cards explaining simply the reading of a meter dial and providing blank spaces for the recording of meter readings for various periods. The Company encourages this as a check, but it does not, however, expect its customers to be responsible for the accuracy of the Company's books. While it is not possible that the overreading of a meter will work any permanent injustice to the customer, or the underreading of a meter will work any permanent injustice to the Company, it is the constant endeavor of the Company and the earnest purpose of its management to provide every safeguard in its accounting methods, and to provide such means for the public that its customers may transact their business with directness and dispatch and with the least possible effort to themselves.

Items of Interest
FROM VARIOUS LOCALITIES.

"H. M. W.," writing from Detroit, under date of the 16th inst., says: "The Corpus Christi Gas Company has been duly organized and chartered to operate a gas plant in Corpus Christi, Tex. The new plant will be of the water gas type and will be constructed on the most modern and up-to-date lines. The apparatus, besides the sets, will include a storage holder, up to retaining 100,000 cubic feet, and one relief holder of a capacity of 10,000 cubic feet. Provision is made for ample purifying and condensing capacity, and the distribution system is to comprise 14.5 miles of mains, the maximum or leaders to be 16 inches diameter. Work on the distribution system will be started the 1st prox., and rushed through with all possible speed, this being necessary in that the city is preparing to pave about 5 miles of streets in which the gas man's plotting calls for the placing of pipes. Builders of gas works who are or may become interested in the specifications for this plant are invited to correspond with the General Construction Company, 706 Union Trust Building, Detroit, Mich."

THE West Coast (Cal.) Gas Company has been incorporated with a capitalization of $250,000. Directors, R. E. L. Sackett, M. B. Sackett, W. A. White, F. C. Millard and W. C. Crittenden.

MR. LAWRENCE POWER, at one time Superintendent of the Montreal (Canada) Gas Company, when that corporation was under the curiously queer dominion of that greatest of all oddities ever developed in the gas business (Jesse Joseph), died at the home of his son, L. Power, Jr., 172 Germain street, Hochelaga, Montreal, the morning of the 5th inst. He was born in Killorin, Wexford, Ireland, December 9, 1831, and from his early youth had been employed in the Cork (Ireland) gas works. Through the offices of the then Field Engineer of Messrs. Drake, who in the early 60's had the contract for quite a bit of work on the Montreal plant, he accepted the position of works' Superintendent in Montreal, the latter part of 1862. In 1873 he accepted a position with the firm of Frothingham & Workman, St. Paul street, Montreal, and in their employment death found him. The only surviving next-of-kin is a son, Lawrence Power, Jr.

A CHAP named F. F. Budd, a sort of "general agitator" living in 210 Lansing street, Utica, N. Y., recently called upon Mayor Baker, of that city, leaving with the latter a document to be publicly spread in the City Hall in the hope of attracting signatures. The gas rate there is $1.20 per 1,000 cubic feet, and the quality of the gas supplied exceeds 20 candles in illuminating value. To a better understanding of the case it may be noted that the petition "*pour* Budd" is of the following shade: "The undersigned residents of Utica, and users of gas, feel that we are paying an exorbitant price for gas, and ask your honorable body (Public Utilities Commissioners, up-State District) to use your authority to relieve us of our excessive burden; and, to show you our knowledge of the cost of gas, will quote you part of a letter in our possession we have from a reputable *firm* that *manufactures* gas plants and *installs* them. *They* (note the swift change to the plural from the singular) were asked to give an estimate for the erection of a gas plant to produce gas for a town of 8,000 inhabitants, and *their* letter says in part: 'The gas can be manufactured for 21 cents per 1,000 cubic feet, and the larger the output the smaller the cost of the gas per 1,000 cubic feet.'"

IT would be worth while knowing the title of the "reputable concern" who put forth this statement; for, no matter who put it forth, it was put forth to deceive. Of course, gas can be made for 21 cents

per 1,000 cubic feet; but what sort of gas? Did this reputable firm declare that it could make 22-candle water gas for 21 cents per 1,000 cubic feet in Utica, and distribute the same to the citizens of Utica for 21 cents per 1,000? This rotten way of putting a case should show that the proposition emanates from builders of the carrion class. However, when the Commissioners for the District get through with the case the Budd story will look like the leaves on the scrub oaks of Long Island in bleak November. Withered, sear and red or brown; but still clinging to the limbs of the parent. The real stench, though, in their outpouring of concealment is that a grain of soundness prevails therein. The base materials that enter into the cost of making 22 candle power gas might be secured for 21 cents, if the make per day went well into the millions; but what of the interest and depreciation charges connected with the purchase of ground site, the cost of machinery, the charges for labor, ditto purification, and the provision for storage—this all from the work's side. Then come the charges for placing street mains, services, meters, bill collections, office force in general, taxes of all sorts; pah! When a man is sworn he agrees to testify to "the truth, the whole truth, and nothing but the truth!" Now, in that view, where does Budd's tricking with the truth come in? Pah!

THE Gas Machinery Company, Cleveland, O., will install a 4 feet 6 inches double-superheater water gas set in the works of the Madison (Ind.) Light and Fuel Company. This installation will complete the reconstruction work which has been underway in Madison, and will put the plant in first-class shape for the demands that will be made upon it this winter.

THE Cleveland (O.) *Plaindealer*, of the 17th inst., notes that the Continental Gas and Electric Company has applied to the Secretary of State, Wilmington, Del., for letters of incorporation, and adds that, "Although no announcement is yet made as to its plans, the Company is believed to be a holding corporation designed to control a number of public utility concerns in various Western States." The concern is to have headquarters in the Schefield building, Cleveland, in the offices of Abbott & Eaton. The concern is modestly capitalized in $7,500,000—of course, that is only a "starter"—and the incorporators are Messrs. Walter H. Abbott and Arley B. Magee. Of course, more will be heard of this budding concern ere the winter lapses into summer; meanwhile we may remark that Mr. Eaton was one of the "engineers" who, some time ago, determined that if bricks could be made without straw, it might be possible that gas could be made out of corn cobs and straw. They tried it out at Beatrice, Neb., in the plant of the Beatrice Gas and Electric Company, with the usual results. Straws seem best fitted for other purpose than the making of gas; and, as for corn cobs, well these seem best adapted for the lowing kine, or the bellowing hog. However, we shall see that which we shall see.

WRITE to the William M. Crane Company, of New York, for a copy of its newest folder, yclept the "Vulcan Bulletin." It is from the Company's own "press," and its get-up reflects good light on the ability of Editor Brooks.

ADVICES from Greenfield, Mass., dated the 18th inst., are to the effect that Superintendent C. F. Butler, of the Greenfield (Mass.) Gas Light Company, has announced that, beginning January 1, 1913, the net rate of $1.50 per 1,000 cubic feet becomes effective on gas sent out after that date. On October 2d, 1910, when the rate was reduced from $2 to $1.80, with 10 per cent. cash discount, the annual sales were 15 millions. At that time Supt. Butler declared the net rate would be put at $1.50 when the sales had gone to 22 millions. As there can be no doubt that that sendout will have been reached by the New Year, the promised rate is now announced. Publication is further made of these facts: Mr. G. L. Hayes, formerly of the Massachusetts Lighting Companies, as Commercial Agent for its West Massachusetts lighting properties, comes to Greenfield in a similar capacity, and Mr. George Guyette, for several years connected with the Greenfield office, takes charge of the Turners' Falls office. Mr. Raymond Jacobus, heretofore located in Turners' Falls, is transferred to Greenfield, to act as salesman in the appliance department.

MR. JOHN VANDENBOUT, since 1906 Superintendent of the Northern Central (Pa.) Gas Company, has been appointed Manager of the Hanover (Pa.) Gas Company. Mr. George B. Hodges succeeds Mr. Vandenbout in the Northern Central Company, with which concern he has been signally successful in the directing of its commercial division.

AT the annual meeting of the Elizabethtown (N. J.) Gas Company the following Directors were re-elected: Ex. U. S. Senator Jno. Kean and Messrs. Julian Kean, Jno. W. Whelan, Hamilton F. Kean and Alexander L. Kean. The Company prospers.

MR. J. W. WILSON, of Goldsboro, N. C., has been appointed Superintendent of the Concord (N. C.) Gas Company.

THE Nobel prize (1912) for "Physics" has been awarded to Mr. Gustaf Dalen, Chief Engineer of the Stockholm (Sweden) Gas Company. And the Nobel prize for "Chemistry" was awarded (jointly) to Prof. Grifnard, of the Nancy (France) University, and to Prof. Paul Sabatier, of the Toulouse (France) University. The value in United States currency of each prize is $38,600.

AT the meeting of the Council of De Pere, Wis., at which was canvassed the votes cast in special election to determine to whom should be awarded the right to supply gas in the named place, the respective vote was thus determined: Wisconsin Gas Company, 440 votes; De Pere Electric Light Company, 306; Green Bay Gas Company, 144—or a total of 860 votes. The tabulations were ordered filed, and it is likely that the offlcial award in the premises will be made at the Council meeting set for to.day.

"FRED. G.," writing from Baltimore, under date of the 15th inst., forwards the following: "About 750 employees of the electric division of the Baltimore Consolidated Gas, Electric Light and Power Company had what the Managers denominated a 'Social Rally' in the Industrial Building, Greenmont avenue and Preston street, the evening of the 12th inst. The Company, of course, acted as host, the aim, of course, being to bring its busy army of workmen into closer social intercourse. Brief speeches were made by Vice-President Herbert A. Wagner, of the electrical division; Douglas Burnet, Manager of the Commercial Division; and E. D. Edmonston, General Superintendent—by-the-way, there is a king in the gas-electric division of our business, 'Dug.' Burnet, as he is known amongst his intimates. And I'm sure that statement will be borne out by one man on your editorial staff. The speeches were all to the point, but that by Vice-President Wagner certainly was enthusiastically received, for during its course he stated that the Company would send 5 of its employees, taken from the ranks, to the annual convention of the National Electric Light Association next July, in Chicago. The men are to be chosen on merit judged by the progress made by them in their work *ad interim*. Following the speeches came an excellent ministrel show, and an appetite satisfyer in the instance of a generous buffet luncheon."

MR. HEVERIN S. REED has been elected President of the Key West (Fla.) Gas Company. Mr. Carter H. Page remains Manager of the Corporation.

THE Jacksonville (Fla.) Gas Company has authorized the Gas Machinery Company, of Cleveland, O., to construct for it a complete new coal gas plant. The generating apparatus is to comprise 6 benches each carrying 6 inclined, sectional, silica retorts and settings, complete, with iron work, charging apparatus, coal and coke handling apparatus, retort house governor and waste heat boiler. Also, complete exhausting, condensing, washing and scrubbing machinery and ammonia concentrating apparatus. Retorts of silica, sectional inclined type are operating very satisfactorily in Mobile, Ala., and installations of this nature have recently been made in Laurium, Mich., and Biloxi, Miss.

A CORRESPONDENT in Wilmington (Del.) writing under date of the 17th inst., says: "Yesterday, in the home of Mr. and Mrs. R. S. Herzog, 1129 Claymont street, this city, the occupants were prostrated from the inhaling of illuminating gas that escaped from an open burner in the gas range. Some fishcakes had been put in a covered dish on the range top, and a rat or rats in attempting to get at them, managed to turn on a burner tap."

WHAT will the old-time duck-hunters, say, of the early 70's, remark, respecting this matter-of-fact statement that was printed last week in the Salisbury (Md.) *Advertiser:* "A combi ned gas and ice plant is to be installed by the Lewes Gas Company. at Chincoteague, Va., the next few weeks. Mr. D. J. Wheatton, of Salisbury, is interested in the project." While this plant is most likely to be of the acetylene or other irregular type, nevertheless its placing there goes to show that horn of the hunter has been replaced by the glare of the gas.

THE New York Public Service Commission, Second District, has ordered the Sea Cliff and Glen Cove Gas Company, of Long Island, to show cause, before the Commissioners in Albany to-morrow, why it should not forthwith make changes and improvements in its plant and service that may seem necessary to the Commissioners. Pretty searching examination by inspectors on the part of the State have shown deficiency in quality and pressure of gas and a disinclination to co-operate with the Commissioners for the desired improvements called for by the conditions.

WE understand that Mr. William Costigan, formerly in the service of the Massachusetts Lighting Companies as an appliance salesman, has been appointed Manager of the new Daytona (Fla.) Gas Company. Just prior to his departure for Daytona, his associates tendered him a farewell sendoff in the headquarters of the Onawa Club, Newton, Mass, which was surely of a nature tending to show his popularty in the district, the residents of which would much regret his leaving them, were it not for the fact that they know it was promotion that lured him.

The Market for Gas Securities.

Consolidated was wobbly all week, rather from lack of trading than from any desire on the part of the holders to sell. We understand that the Company is having very little trouble in getting rid of its coke these days, the fruit of the intelligent campaign carried on in this city by the Company in the last 3 years. If we mistake not this campaign had its inception in the thought of Mr. Walter R. Addicks, whose planning was enthusiastically seconded by Chief Bradley, Engineer of manufacture Woods and Messrs. Simpson and Nelson. It is true that the higher rates for anthracite and for fuel oil "helped some;" but the main factor was the intelligent co-operation of the gentlemen named. It might also be said that at least one Director, at the end of the second year of the trying, wanted a return to the old coke day methods; but these are done for good. The opening quotation to-day (Friday) came in at 143 to 143½. Keep your glasses occasionally directed towards quotations for "Con."

Congressman Levy, and that other political monstrosity "Burke Cockran"—you can spell his name pretty much as you like, did not make much impression on the Brooklyn Union people in respect to getting their hands a trifle deeper in its treasury. Think of that due being in charge of the Company's legal division! Wow! Wow!! Brooklyn Union is 144 to 144½. Peoples, of Chicago, is steady, as in fact seems the case with all the gas numbers on the list.

The Brooklyn Union Gas Company has declared a quarterly dividend of 1½ per cent., and an extra of 1 per cent. Both are payable Jan. 2, 1913, to holders of record, Dec. 14, 1912.

Gas Stocks.

Quotations by George W. Close, Broker and Dealer in Gas Stocks.

115 BROADWAY, NEW YORK CITY.

NOVEMBER 25.

☞ All communications will receive particular attention.

☞ The following quotations are based on the par value of $100 per share:

N. Y. City Companies.	*Capital.*	*Par.*	*Bid.*	*Asked*
Consolidated Gas Co.	$78,177,000	100	143	143¼
Central Union Gas Co.—				
1st 5's, due 1972, J. & J.	3,000,000	1,000	103	105
Equitable Gas Light Co.—				
Con. 5's, due 1962, M. & S.	1,000,000	1,000	105	106
Mutual Gas Co.	3,500,000	100	182	187
New Amsterdam Gas Co.—				
1st Con. 5's, due 1948, J. & J.	11,000,000	1,000	101	102½
New York & Richmond Gas				
Co. (Staten Island)	1,500,000	100	35	50
1st Mtg. Gold Bds. 5 p. ct.	1,500,000	—	98½	100½
New York and East River—				
1st 5's, due 1944, J. & J.	3,500,000	1,000	103	105
Con. 5's, due 1945, J. & J.	1,500,000	—	95	100
Northern Union—				
1st 5's, due 1927, J. & J.	1,250,000	1,000	99½	101
Standard	5,000,000	100	60	70
Preferred	5,000,000	100	90	100
1st Mtg. 5's, due 1930, M. & N.	1,500,000	1,000	103	105
The Brooklyn Union	15,000,000	1,000	144	146½
1st Con. 5's, due 1948, M. & N.	15,000,000	—	105¾	107
Yonkers	999,650	500	130	—
Out-of-Town Companies.				
Bay State	50,000,000	50	⅝	¾
" Income Bonds	2,000,000	1,000	—	75
Binghampton Gas Works	450,000	100	—	—
" 1st Mtg. 5's	500,000	1,000	97	100
Boston United Gas Co.—				
1st Series S. F. Trust	7,000,000	1,000	82	85
2d " " "	3,000,000	1,000	47½	50
Buffalo City Gas Co.	5,500,000	100	5	8
Bonds, 5's	5,250,000	1,000	59	60
Capital, Sacramento	500,000	50	—	85
Bonds (6's)	150,000	1,000	—	—
Chicago Gas Co. Guaranteed				
Gold Bonds	7,660,000	1,000	104	106¼
Cincinnati Gas and Electric				
Co.	22,500,000	100	87	90
Essex and Hudson Gas Co.	6,500,000	—	133	136
Fort Wayne	2,000,000	—	—	—
" Bonds	2,000,000	—	55	—
Grand Rapids Gas Light Co.,				
1st Mtg. 5's	1,350,000	1,000	100	101
Hartford	750,000	25	190	200
Hudson County Gas Co., of				
New Jersey	10,500,000	—	130	133
" Bonds, 5's	10,500,000	—	104	106
Indianapolis	2,000,000	—	38	45
" Bonds, 5's	2,650,000	—	104½	105
Jackson Gas Co.	250,000	50	82	—
" 1st Mtg. 5's	290,000	1,000	91	95
Kansas City Gas Light Co.,				
of Missouri	5,000,000	100	—	86
Bonds, 1st 5's	3,822,000	1,000	98½	99
Laclede Gas Co., St. Louis.	10,000,000	100	105½	106
Preferred	2,500,006	100	99	102
Bonds	10,000,000	1,000	102½	103
Lafayette Gas Co., Ind.	1,000,000	100	—	60
Bonds	1,000,000	1,000	60	65
Louisville	2,570,000	50	120	130
Madison Gas and Electric Co.				
" 1st Mtg. 6's	400,000	1,000	106	
Massachusetts Gas Companies, of Boston	25,000,000	100	93½	94
Preferred	25,000,000	100	95½	96
Montreal Gas Co., Canada	2,000,000	100	223	225
Nashville Gas Light Co.	1,000,000	100	110	—
Newark, N. J., Con. Gas Co.	6,000,000	—	97	98
Bonds, 6's	6,000,000	—	127	128
New Haven Gas Co.	5,000,000	25	182	190
Peoples Gas Lt. & Coke Co.,				
Chicago	25,000,000	100	116½	117
1st Mortgage	20,100,000	1,000	102	102½
2d "	2,500,000	1,000	104	—
Rochester Gas & Electric Co.	2,150,000	50	88	—
Preferred	2,150,000	50	118	—
Consolidated 5's	2,000,000	—	104¾	105½
Pacific Gas and Electric Co.	15,500,000	—	65	65¼
St. Joseph Gas Co.—				
1st Mtg. 5's	1,000,000	1,000	96	98
St. Paul Gas Light Co.	2,500,000	100	—	—
1st Mortgages, 6's	650,000	1,000	104	106
Extension, 6's	600,000	1,000	112¾	115
General Mortgage, 5's	3,447,000	1,000	94	96
Syracuse Gas Co., N. Y.	1,975,000	100	50	55
Bonds	2,047,000	1,000	101	103
Washington (D. C.) Gas Co.	1,600,000	200	420	425
1st Mortgage, 6's	600,000	—	—	—
Western Gas Co., Milwaukee	4,000,000	—	—	—
Wilmington (Del.) Gas Co.	600,000	50	—	—

MEETING TIMES OF THE VARIOUS GAS ASSOCIATIONS.

American Gas Institute.—Annual meeting, October 15-17, 1913. Officers: President, W. R. Addicks, New York City. Secretary, Geo. G. Ramsdell, 29 West 39th st., N. Y. City.

Canadian Gas Association.—Annual meeting Sept. 1913. Officers: President, Arthur Hewitt, Toronto, Ont.; Secretary and Treasurer, John Keillor, Hamilton, Ont.

Empire State Gas and Electric Association.—Annual meeting, New York City, Oct. 8, 1913. Officers: President, C. G. M. Thomas, Long Island City, N. Y.; Secretary, C. H. B. Chapin, 29 W. 39th street, New York City.

Gas Meters.—Next Meeting, Newark, Dec. 18; Chairman, Will W. Barnes; Commissioners, W. H. Pettes, I. W. Peffly: Secretary, H Thurston Owens, 42 Pine street, New York City. Philadelphia Section; Chairman, L. R. Dutton; Commissioners, S. Grady, H. P. Dains: Secretary, H. F. Patterson, Jr., 831 Chestnut street.

Guild of Gas Managers of New England.—Annual meeting, March, 1913. Young's Hotel, Boston; monthly meeting, second Saturday. Officers: President, Walter G. Africa, Manchester, N. H.; Secretary, H. K. Morrison, Brockton, Mass.

Illinois Gas Association.—Annual meeting, March 19th and 20th, 1913. Chicago, Ills. Officers: President, H. O. Channon, Quincy, Ills.; Secretary-Treasurer, Horace H. Clark, 115 No. Oak Park avenue, Oak Park, Ills.

Illuminating Engineering Society.—Annual meeting,———— September, 1913. Meetings of Sections, monthly. Pres., V. R. Lansingh, Cleveland, O.; Sec., Preston S. Millar, 29 W. 39th street, New York City. Sections: New York, Secretary, C. L. Law, 124 West 42d street. New England, Secretary, H. C. Jones, 10 High street, Boston, Mass. Philadelphia, Secretary, L. B. Eichengreen, Broad and Arch streets. Chicago, Secretary, J. B. Jackson, 28 North Market street. Pittsburgh, Secretary, J. C. Mundo, Oliver Building.

Indiana Gas Association.—Annual meeting, March 12 and 13, 1913. Indianapolis. Officers: President, Howard L. Olds, Indianapolis; Vice-President, Wm. Wallace, Lafayette; Secretary-Treasurer, Philmer Eves, Indianapolis.

Iowa District Gas Association.—Annual meeting, Burlington, Ia., May 22, 23, 24, 1913; Officers: President, C. W. Fair, Atlantic, Ia.; Secretary, G. I. Vincent, Des Moines, Ia.

Kansas Gas, Water and Electric Light Association.—Annual meeting, October—— 1913. ———— Officers: President, L. O. Ripley, Emporia, Kas.; Secretary and Treasurer, W. H. Fellows, Leavenworth, Kas.

Michigan Gas Association—Annual meeting, September——1913; ———— Officers: President, W. S. Blauvelt, Detroit, Mich; Secretary-Treasurer, Glenn R. Chamberlain, Grand Rapids, Mich.

Missouri Electric Light, Gas, Water Works and Street Railway Association.—Annual meeting, April, 1913; Joplin, Mo. Officers: President, P. A. Bertrand, Joplin, Mo.; Secretary and Treasurer, P. W. Markham, Brookfield, Mo.

National Commercial Gas Association.—Annual meeting and Gas Show, Dec. 2-5, 1912. Atlanta, Ga. Officers: President, C. L. Holman, St. Louis, Mo.; Secretary, Louis Stotz, 29 West 39th street, New York City.

Natural Gas Association.—Annual meeting, Cleveland, O., May, 1913; Officers: President, M. B. Daly, Cleveland, O; Secretary, T. C. Jones, Delaware, O.

New England Gas Association.—Annual meeting, February,————1913 Boston. Officers: President, D. D. Barnum, Worcester, Mass.; Secretary-Treasurer, N. W. Gifford, East Boston, Mass.

New Jersey State Gas Association.—Winter Meeting. December 18, Newark N. J.—President, William H. Pettes, Newark, N. J.; Secretary-Treasurer, Arthur H. Osborn Belmar, N. J.

Ohio Gas Association.—Annual meeting, February ———, 1913, Columbus, O.; President, John M. Garard, Columbus, O.; Secretary, L. B. Denning, Columbus, O.

Oklahoma Gas, Electric and Railway Association.—Annual meeting, May, 1913. President, Noel B. Gascho, Alva, Okla.; Secretary, H. V. Bozell, Norman, Okla.

Pacific Coast Gas Association.—Annual meeting, San Jose, Cal., September 16, 17, 18 1913. Officers: President, Henry E. Adams, Stockton, Cal.; Secretary-Treasurer, Henry B stwick, 445 Sutter street, San Francisco, Cal.

Pennsylvania Gas Association.—Annual meeting, York, Pa., April, 1913; Officers, President, H. H. Ganser, Norristown, Pa.; Secretary-Treasurer, W. O. Lamson, Jr., West Chester, Pa.

Society of Gas Lighting.—Annual meeting Dec., 18, 1912; monthly meetings, second Thursday. Place, New York City. Officers: President, Fred. S. Benson; Secretary, George G. Ramsdell, 29 West 39th street, New York city

Southern Gas Association.—Annual meeting, Charlotte, N. C., April———— 1913, Officers: President, C. E. White, Montgomery, Ala.; Secretary-Treasurer, E. D. Brewer, Atlanta, Ga.

Southwestern Electrical and Gas Association.—Annual meeting. April————1913, Galveston, Tex. Officers: President, F. M. Lege, Jr., Galveston, Tex.; Secretary H. S. Cooper, 405 Slaughter Bldg., Dallas, Tex.

Wisconsin Gas Association.—Annual meeting, May ———— 1913, Milwaukee, Wis. Officers: President, I. F. Wortendyke, Janesville, Wis.; Secretary-Treasurer, Henry Harmon, Milwaukee, Wis.